



BEST AVAILABLE COPY

SLRFLR.0009P

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	George A. Zimmerman, et al.	)	Group Art Unit: 2644
			)	
Appl. No.	:	10/603,498	)	
			)	
Filed	:	June 24, 2003	)	
			)	
For	:	METHOD AND APPARATUS	)	
		FOR PRECODE CROSSTALK	)	
		MITIGATION	)	
			)	
Examiner	:	Walter F. Briney III	)	
			)	

AFFIDAVIT OF PRIOR INVENTION UNDER 37 C.F.R. § 1.132  
BY APPLICANTS' ATTORNEY, CHAD W. MILLER

I, Chad W. Miller, hereby declare as follows,

1. I am a resident of the State of Nevada, U.S.A. I make this declaration on personal knowledge, and if called on sworn as a witness, I could and would competently testify as set forth below.
2. I acknowledge that any willful false statements and the like are punishable by fine or imprisonment, or both under 18 U.S.C. § 1001 and may jeopardize the validity of the application or any patent issuing thereon.
3. All statements made herein are based on my own knowledge, are true, and all statements made on information and belief are believed to be true.
4. I am a registered patent attorney and have been retained to represent Solarflare Communications, Inc.
5. I prepared and filed U.S. Provisional Patent Application 60/424,961 entitled Method and Apparatus For Joint Equalization and Crosstalk Mitigation on November 7, 2002. The above-referenced patent application claims priority to this provisional application.
6. After preparation and review of the provisional application (attorney docket number SLRFLR.0004P and application number 60/424,961) the decision was made to file two utility applications, both of which claim priority to this provisional because of the rule against multiple inventions in one utility patent. The attorney docket numbers and application serial number for each utility application is as follows: SLRFLR.0004P, application number 10/603,417 and SLRFLR.0009P, application number 10/603,498. The fact that the subject matter for two utility

applications was contained within the one provisional application supports the conclusion that the application was long and complex.

7. I met with the inventors to obtain an invention disclosure so that I may draft the patent application. During this meeting I received information that I used to prepare the provisional patent application that evidenced that the inventors were in possession of the subject matter claimed in the above-referenced application. The Affidavits of W. Jones and G. Zimmerman, which were previously submitted, support this assertion.

8. After the invention disclosure meeting I proceeded to prepare a first draft of the provisional patent application. The provisional patent application contains support for the claimed subject matter in the above-referenced application. The provisional application has the client code SLRFLR.0004P as shown at the top of the invoice. The above-reference application has the client code SLRFLR.0009P.

9. Exhibit A, submitted herewith, is a copy of the July 2002 invoice for services rendered to Solarflare in June, 2002. Solarflare is the employer of the Applicants and is the owner of the above-referenced application by assignment. The invoice evidences that I was in possession of the invention and working diligently on the application or other related applications during June of 2002. For the client code SLRFLR.0004P, this invoice shows that I reviewed the disclosure notes and began drafting on June 12, 2002.

10. Exhibit B, submitted herewith, is a copy of the August invoice for services rendered to Solarflare in July, 2002. The invoice evidences that I worked diligently on the application, reference number SLRFLR.0004P and other related applications for Solarflare during July of 2002.

11. Solarflare applications having reference numbers other than SLRFLR.0004P and SLRFLR.0009P were directed to the same or closely related subject matter, both claim priority to the same provisional application, and had potential bar dates. In my opinion, all of the Solarflare applications are inter-related as all Solarflare patent applications deal with signal processing to achieve high rate data communication.

12. I worked on numerous if not all of the Solarflare applications during the months of June through November. Many of the applications had bar dates that necessitated filings to prevent loss of rights, and work on these applications was closely related to and intertwined the above-referenced application. For example, on July 1, 2002, I filed a patent application (attorney docket number SLRFLR.0002P) directed to Method and Apparatus for Channel Equalization. On July 10, 2002, I also filed a patent application (attorney docket number SLRFLR.0003P) directed to a Communication System. On July 10, 2002 I also filed a patent application (attorney docket number SLRFLR.0005P) directed to a Method and Apparatus for Constellation Shaping. In addition to all these filing, I still diligently worked on the provisional patent application for

attorney docket number SLRFLR.0004P to which the above-referenced application claims priority.

13. Exhibit C, submitted herewith, is a copy of the September 2002 invoice for services rendered to Solarflare in August, 2002. The invoice evidences that I worked diligently on the provisional patent application and other related applications during August 2002. In particular, when looking at the days worked for matters relating to attorney docket numbers SLRFLR.0004P and SLRFLR.0009P, I worked on the application on the following days: August 7, 8, 9, 11, 12, 13, 14, 15, 16, 18, 20, 27, 28, and 30. The weekends are on the following days: 3, 4, 10, 11, 17, 18, 24, and 25. On the 2nd of August my time records show I was sick for most of the day.

14. As shown in Exhibit C, on August 30, 2002, I forwarded a first draft of the application to the Applicants for review and revision. Although not evidenced in an Exhibit, I maintained communication with the inventors thereafter.

15. For some reason, the Applicants did not receive the mailed copy of the application, so on September 9, 2002, I e-mailed a copy of the application to the Applicants. An e-mail is attached as Exhibit G showing that I re-transmitted the application via e-mail for review on September 9, 2002.

16. Exhibit D, attached herewith, is a copy of the provisional application as sent to the Applicants for review. The draft application contained numerous blanks, questions, and sections that needed substantial review and supplementing by the Applicants. Reviewing the draft applications was not standard, in that the Applicants were not simply reading through a polished application and signing off.

17. As shown in the draft patent application in Exhibit D, the Application contains comments, request for help, or blanks to be filled in on pages 4, 14, 15, 16, 20, 24, 25, 26, and 28. To further support the extent of the review and changes and show that the Applicants were diligent in their substantial review, Applicants made changes to the draft on pages 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 21, 22, 23, 24, 27, 28, 30, 33, 36, 37 out of 37 pages total. It is clear that substantial effort was required by the Applicants to complete their review. Thus, it is my opinion that the Applicants made substantial changes and for the Applicants to have completed the review, testing, revisions, and discussion before November 7, 2002 they would have had to work diligently.

18. Exhibit E, attached herewith, is a copy of the October invoice for services performed for Solarflare during September, 2002. During this period, at least one of the Applicants was occupied reviewing another application. In particular, on 9/9/02 for attorney docket number SLRFLR.0006P, a related application, I e-mailed W. Jones another application for review. On 9/17/02 I conducted a conference call with W. Jones regarding changes/clarification to this application. This evidences that W. Jones was diligently working on related patent matters, in

addition to his review of the provisional application to which the above-referenced application claim priority. It is my opinion that these two applications are closely related.

19. During October 2002 I had numerous conference calls with the Applicants regarding the required changes in the provisional patent application. As a rule, I do not bill for such calls because such calls result from my lack of understanding regarding the subject matter, or from errors I have made in the application. I treat such calls as part of learning the technology, which I consider non-billable. Review of the invoices submitted in Exhibits evidence that I do not charge for such work.

20. Based on my numerous conversations with the Applicants during September and October of 2002, Applicants were clearly diligent in reviewing the provisional patent application.

21. During September and October of 2002 I was busy working on other related applications for Solarflare. Exhibit F, attached herewith, is the November 2002 invoice for services performed during October 2002 for Solarflare. This invoice evidences that I was working, almost daily, on attorney docket numbers SLRFLR.0007P, SLRFLR.0010P, and SLRFLR.0011P. The projects hindered my ability to interface with the Applicants which slowed the review by the Applicants of the provisional application. This delay is excusable because I was working on projects in chronological order and based on deadlines imposed by Solarflare's disclosure schedule.

22. Exhibit H, attached herewith, is a copy of the December 2002 invoice for services performed for Solarflare during November, 2002. This invoice shows that I diligently worked on Solarflare matters during November and that the provisional application was filed on November 7, 2002.

23. Exhibit I, attached herein, is a copy of all of billed time entries that were sent out to client for payment. These entries are for the time period of September 1, 2002 to October 31, 2002. This list does not include vacation days, sick days, non-billable time, CLE, or pro bono work. I have redacted the attorney docket numbers on non-Solarflare matters to protect attorney-client privilege.

24. This list of a time entries in Exhibit I provides evidence that I was busy with numerous client matters during this time period and this level of work hindered my ability to interface with the Applicants. Although the Applicants attempted the schedule time to address and discuss the first draft of the provisional patent application, I often had to delay the conference calls to address my other work load in chronological order and to address bar dates. The projects I was working on were approached in chronological order and through no lack of diligence on my behalf or the Applicants behalf, hindered my ability to advance the Applicants' review of the provisional patent application.

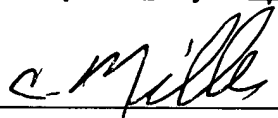
25. As shown in Exhibit H, in the attorney docket numbers SLRFLR.0001G and SLRFLR.0004P file on November 4<sup>th</sup> I reminded the Applicants regarding a potential foreign filing bar and received the revised application from the Applicants on November 5th.

26. On November 6<sup>th</sup>, I worked with my secretary to gather the information needed for filing of a provisional application and on November 7<sup>th</sup>, as evidenced by the filing date of the provisional application, I filed the provisional application to which this application claims priority.

27. From this evidence it is clear that the Applicants and I were reasonably diligent in the preparation of the patent application between the relevant dates of June 7, 2002 and November 7, 2002. It is my opinion and belief that the attached documents provided as Exhibits herewith and this sworn Affidavit provides evidence of reasonable diligence between the dates of June 7, 2002 and

28. I declare under Penalty of Perjury under the laws of the United States of America that the foregoing is true and correct.

Executed this 12 day of April, 2006.

By:   
Chad W. Miller

**Weide & Miller, Ltd.**

330 South 3rd Street

Suite 1130

Las Vegas, NV 89101

Voice: 702-382-4804

Facsimile: 702-382-4805

Date Generated/Mailed: July 03, 2002

Invoice submitted to: SolarFlare Communications, Inc.

9501 Jeronimo Road, Suite 100

Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**To: **Subject Matter: General Intellectual Property Representation****Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
6/25/02	CWM	Conference W. Jones regarding status of cases and scheduling of upcoming disclosures	0.40 220.00/hr	88.00
6/30/02	CWM	Prepare scheduling report document	0.20 220.00/hr	44.00
		For professional services rendered	0.60	<u>\$132.00</u>
		Previous balance		\$22.00
7/3/02		Payment - thank you. Check No. 1571		<u>(\$22.00)</u>
		Total payments and adjustments		<u>(\$22.00)</u>
		<b>Balance due</b>		<u><u>\$132.00</u></u>

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Transmission Line Equalization**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
6/5/02	CWM	Review inventor changes to application; revise application	1.60 220.00/hr	352.00
6/6/02	CWM	Review and revise claims based on comments from W. Jones	2.20 220.00/hr	484.00
6/7/02	CWM	Draft claims	2.50 220.00/hr	550.00
6/10/02	CWM	Continue drafting claims	4.20 220.00/hr	924.00
6/14/02	CWM	Make final changes to application and forward same to B. Jones	1.30 220.00/hr	286.00
6/19/02	CWM	Review e-mail from W. Jones with second draft of application attached; confer with W. Jones regarding same	0.20 220.00/hr	44.00
6/20/02	CWM	Review e-mail with attachment from W. Jones; review changes and formatting and initiate preparation of formal papers	0.30 220.00/hr	66.00
6/24/02	CWM	Prepare formal papers	0.80 220.00/hr	176.00
		For professional services rendered	<hr/> 13.10	<hr/> \$2,882.00
		Previous balance		\$1,166.00
7/3/02		Payment - thank you. Check No. 1571		<hr/> (\$1,166.00)
		Total payments and adjustments		<hr/> (\$1,166.00)
		Balance due		<hr/> \$2,882.00

In Reference      **Weide & Miller Ref. No.: SLRFLR.0003P**  
 To:                **Subject Matter: Patent Prosecution**  
                       **Title: Communication System**  
                       **Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
6/11/02	CWM	Review existing claims and draft additional claims	2.60 220.00/hr	572.00
6/13/02	CWM	Draft summary and make minor revisions to claims and detailed description	1.10 220.00/hr	242.00
6/14/02	CWM	Perform final changes to application and forward same to B. McClellan	0.90 220.00/hr	198.00
6/24/02	CWM	Prepare formal papers	0.80 220.00/hr	176.00
6/30/02	CWM	Revise specification and figures based on new details provided by B. McClellan during meeting	0.80 220.00/hr	176.00
For professional services rendered			6.20	<b>\$1,364.00</b>
Previous balance				<b>\$7,942.00</b>
7/3/02	Payment - thank you. Check No. 1571			(\$7,942.00)
Total payments and adjustments				(\$7,942.00)
<b>Balance due</b>				<b>\$1,364.00</b>



In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
6/12/02	CWM	Review disclosure notes and prior art	1.10 220.00/hr	242.00
6/19/02	CWM	Review disclosure notes and outline application	2.30 220.00/hr	506.00
6/20/02	CWM	Draft Background section	1.40 220.00/hr	308.00
6/21/02	CWM	Review disclosure notes and tape; create figures	4.50 220.00/hr	990.00
6/23/02	CWM	Draft figures and review disclosure notes	2.20 220.00/hr	484.00
		For professional services rendered	11.50	<b>\$2,530.00</b>
		Previous balance		<b>\$682.00</b>
7/3/02		Payment - thank you. Check No. 1571		(\$682.00)
		Total payments and adjustments		<b>(\$682.00)</b>
		<b>Balance due</b>		<b>\$2,530.00</b>

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Constellation Shaping**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
6/10/02	CWM	Review and revise application and figures; divide cases	3.20 220.00/hr	704.00
6/11/02	CWM	Review existing claims and draft additional claims	1.80 220.00/hr	396.00
6/12/02	CWM	Draft claims	2.20 220.00/hr	484.00
6/14/02	CWM	Perform final changes to application and forward same to B. McClellan	2.40 220.00/hr	528.00
6/23/02	CWM	Make changes to application as requested by B. McClellan	1.60 220.00/hr	352.00
6/24/02	CWM	Prepare formal papers	0.80 220.00/hr	176.00
6/25/02	CWM	Conference with B. McClellan regarding new subject matter to be included in specification regarding encoding of control codes	1.00 220.00/hr	220.00
		For professional services rendered	<u>13.00</u>	<u>\$2,860.00</u>
		Previous balance		<u>\$2,464.00</u>
7/3/02	Payment - thank you. Check No. 1571			<u>(\$2,464.00)</u>
		Total payments and adjustments		<u>(\$2,464.00)</u>
		Balance due		<u>\$2,860.00</u>

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Multiple Channel Interference Cancellation**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
6/24/02	CWM	Prepare for meeting by reviewing invention disclosure form and other technical references	0.60 220.00/hr	132.00
6/25/02	CWM	Conference with W. Jones at SolarFlare offices to obtain invention disclosure; prepare for same	3.60 220.00/hr	792.00
		For professional services rendered	<u>4.20</u>	<u>\$924.00</u>
		<b>Balance due</b>		<u><u>\$924.00</u></u>

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Communication System Constellation Shaping Serial No.:**  
Not yet assigned

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
6/25/02	CWM	Conference with L. Cohen regarding subject matter of invention	0.70 220.00/hr	154.00
		For professional services rendered	0.70	<b>\$154.00</b>
		<b>Balance due</b>		<b>\$154.00</b>

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: July 03, 2002

Invoice submitted to: **SolarFlare Communications, Inc.**  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**  
To: **Subject Matter: General Intellectual Property Representation**

New Fees	New Costs	Total New Charges
\$132.00	\$0.00	\$132.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Transmission Line Equalization**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$2,882.00	\$0.00	\$2,882.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Communication System**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$1,364.00	\$0.00	\$1,364.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$2,530.00	\$0.00	\$2,530.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Constellation Shaping**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$2,860.00	\$0.00	\$2,860.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Multiple Channel Interference Cancellation**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$924.00	\$0.00	\$924.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Communication System Constellation Shaping** **Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$154.00	\$0.00	\$154.00

Summary For All Matters:

\$10,846.00

\$0.00

\$10,846.00

GRAND TOTAL OF ALL AMOUNTS  
DUE:

\$10,846.00

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: August 06, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**  
To: **Subject Matter: General Intellectual Property Representation**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
7/1/02	CWM	Update status report	0.20 220.00/hr	44.00
7/9/02	CWM	Conference with W. Jones regarding Consultant agreement; review same	0.50 220.00/hr	110.00
7/10/02	CWM	Draft e-mail providing opinion of current status of Consultant's Agreement and propose format for consultant to complete agreement	1.00 220.00/hr	220.00
		For professional services rendered	<hr/> 1.70	<hr/> \$374.00
		Previous balance		\$132.00
8/4/02		Payment - thank you. Check No. 1644		(\$132.00)
		Total payments and adjustments		<hr/> (\$132.00)
		Balance due		<hr/> <hr/> \$374.00



In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Channel Equalization**  
**Serial No.: 10/188,274**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
7/1/02	CWM	File patent application with Patent and Trademark Office; prepare transmittal and review same	1.00 220.00/hr	220.00
7/3/02	CWM	Draft letter to client enclosing filed application; initiate preparation of document binder	0.20 220.00/hr	44.00
		For professional services rendered	1.20	<b>\$264.00</b>
		<b>Additional Charges :</b>		
7/1/02		U.S. Patent and Trademark Office Filing Fee (small entity)		595.00
		U.S. Patent and Trademark Office Assignment Recordation Fee		40.00
		Total costs		<b>\$635.00</b>
		Total amount of this bill		<b>\$899.00</b>
		Previous balance		<b>\$2,882.00</b>
8/4/02		Payment - thank you. Check No. 1644		(\$2,882.00)
		Total payments and adjustments		<b>(\$2,882.00)</b>
		<b>Balance due</b>		<b>\$899.00</b>

In Reference **Weide & Miller Ref. No.:** SLRFLR.0003P  
 To: **Subject Matter:** Patent Prosecution  
**Title:** Communication System  
**Serial No.:** 10/194,775

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
7/10/02	CWM	Oversee and review transmittal; file patent application	1.00 220.00/hr	220.00
7/16/02	CWM	Draft and send letter enclosing filed patent application	0.10 220.00/hr	22.00
		For professional services rendered	1.10	<b>\$242.00</b>

**Additional Charges :**

7/10/02	Assignment Recordation Fee	40.00
	U.S. Patent and Trademark Office Filing Fee (small entity)	526.00
	Total costs	<b>\$566.00</b>
	Total amount of this bill	<b>\$808.00</b>
	Previous balance	<b>\$1,364.00</b>
8/4/02	Payment - thank you. Check No. 1644	(\$1,364.00)
	Total payments and adjustments	<b>(\$1,364.00)</b>
	<b>Balance due</b>	<b>\$808.00</b>

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0004P**  
**Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
7/4/02	CWM	Draft patent application	2.70 220.00/hr	594.00
7/5/02	CWM	Draft patent application and update figures	4.60 220.00/hr	1,012.00
7/7/02	CWM	Draft patent application	2.80 220.00/hr	616.00
7/30/02	CWM	Conference with G. Zimmerman and W. Jones to obtain follow-up information; prepare for same	1.40 220.00/hr	308.00
		For professional services rendered	11.50	<b>\$2,530.00</b>
		Previous balance		<b>\$2,530.00</b>
8/4/02		Payment - thank you. Check No. 1644		(\$2,530.00)
		Total payments and adjustments		<b>(\$2,530.00)</b>
		<b>Balance due</b>		<b>\$2,530.00</b>

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Constellation Shaping**  
**Serial No.: 10/194,741**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
7/1/02	CWM	Review and revise application and figures; draft e-mails to B. McClellan attaching final draft of patent application	3.60 220.00/hr	792.00
7/3/02	CWM	Review e-mail from B. McClellan and conduct call with B. McClellan; revise application accordingly	2.70 220.00/hr	594.00
7/5/02	CWM	Draft portion of additional claim set based on e-mail from B. McClellan	1.80 220.00/hr	396.00
7/8/02	CWM	Draft additional claims set and confer with B. McClellan regarding same; send revised claim set to B. McClellan; review e-mail approving same	2.40 220.00/hr	528.00
7/10/02	CWM	Review transmittal; oversee filing of patent application	1.00 220.00/hr	220.00
7/16/02	CWM	Draft and send letter enclosing filed patent application	0.10 220.00/hr	22.00
For professional services rendered			11.60	<b>\$2,552.00</b>
<b>Additional Charges :</b>				
7/10/02	Assignment Recordation Fee			40.00
	U.S. Patent and Trademark Office Filing Fee (small entity)			637.00
Total costs				<b>\$677.00</b>
Total amount of this bill				<b>\$3,229.00</b>
Previous balance				<b>\$2,860.00</b>
8/4/02	Payment - thank you. Check No. 1644			<b>(\$2,860.00)</b>
Total payments and adjustments				<b>(\$2,860.00)</b>

Amount

**Balance due**

**\$3,229.00**

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0006P**  
**Subject Matter: Patent Prosecution**  
**Title: Multiple Channel Interference Cancellation**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
7/15/02	CWM	Review disclosure and draft background and portion of detailed description	3.00 220.00/hr	660.00
7/16/02	CWM	Revise and supplement figures	0.60 220.00/hr	132.00
7/17/02	CWM	Draft patent application and revise figures	2.70 220.00/hr	594.00
7/18/02	CWM	Draft patent application	3.30 220.00/hr	726.00
7/19/02	CWM	Continue drafting patent application	5.20 220.00/hr	1,144.00
7/23/02	CWM	Revise figures	0.90 220.00/hr	198.00
7/25/02	CWM	Draft patent application and revise figures	2.80 220.00/hr	616.00
7/26/02	CWM	Draft patent application	2.70 220.00/hr	594.00
		For professional services rendered	21.20	<b>\$4,664.00</b>
		Previous balance		<b>\$924.00</b>
8/4/02		Payment - thank you. Check No. 1644		(\$924.00)
		Total payments and adjustments		<b>(\$924.00)</b>
		<b>Balance due</b>		<b>\$4,664.00</b>

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Bandwidth Enhancement of Transformers**  
**Serial No.: Not yet assigned**

**Professional Services**

		<u>Hrs/Rate</u>	<u>Amount</u>
7/30/02	CWM Conference with inventors to obtain invention disclosure; prepare for meeting by reviewing prior information provided by inventors	2.80 220.00/hr	616.00
	For professional services rendered	<u>2.80</u>	<u>\$616.00</u>
	Previous balance		<u>\$154.00</u>
8/4/02	Payment - thank you. Check No. 1644		<u>(\$154.00)</u>
	Total payments and adjustments		<u>(\$154.00)</u>
	<b>Balance due</b>		<u><u>\$616.00</u></u>

In Reference      **Weide & Miller Ref. No.:** SLRFLR.0008P  
To:                    **Subject Matter:** Patent Prosecution  
                         **Title:** Method and Apparatus for Cancellation Using Mixed Signal Processing  
                         **Serial No.:** Not yet assigned

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
7/28/02	CWM	Draft portion of application dealing with second embodiment	2.70 220.00/hr	594.00
7/29/02	CWM	Continue drafting portion of application dealing with second embodiment	3.80 220.00/hr	836.00
7/30/02	CWM	Conference with B. Jones to obtain follow-up information; prepare for meeting	1.30 220.00/hr	286.00
			<hr/>	<hr/>
		For professional services rendered	7.80	<b>\$1,716.00</b>
				<hr/>
		<b>Balance due</b>		<b>\$1,716.00</b>
				<hr/> <hr/>



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Date Generated/Mailed: August 06, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**  
To: **Subject Matter: General Intellectual Property Representation**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$374.00	\$0.00	\$374.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Channel Equalization**  
**Serial No.: 10/188,274**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$264.00	\$635.00	\$899.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Communication System**  
**Serial No.: 10/194,775**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$242.00	\$566.00	\$808.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**  
 To: **Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Joint Equalization and Crosstalk Mitigation  
**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$2,530.00	\$0.00	\$2,530.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**  
 To: **Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Constellation Shaping  
**Serial No.:** 10/194,741

New Fees	New Costs	Total New Charges
\$2,552.00	\$677.00	\$3,229.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**  
 To: **Subject Matter:** Patent Prosecution  
**Title:** Multiple Channel Interference Cancellation  
**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$4,664.00	\$0.00	\$4,664.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**  
 To: **Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Bandwidth Enhancement of Transformers  
**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$616.00	\$0.00	\$616.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0008P**  
To: **Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Cancellation Using Mixed Signal Processing  
**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$1,716.00	\$0.00	\$1,716.00

Summary For All Matters:

\$12,958.00	\$1,878.00	\$14,836.00
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GRAND TOTAL OF ALL AMOUNTS DUE:	\$14,836.00
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WEIDE &  
MILLER, Ltd.

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PATENT, TRADEMARK, COPYRIGHT & TRADE SECRET MATTERS

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On the web: www.WeideMiller.com

CHAD W. MILLER  
REGISTERED PATENT ATTORNEY  
LICENSED IN CALIFORNIA & NEVADA

September 12, 2002

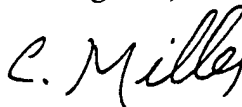
Mr. Ben Charny  
Executive Vice President and CFO  
SolarFlare Communications, Inc.  
9501 Jeronimo Rd., Suite 100  
Irvine, CA 92618

Re: Invoice for September 2002

Dear Ben:

Enclosed is the invoice for September 2002. We apologize for its lateness. At the beginning of the month, we notified George Zimmerman of the total amount due.

Best Regards,



Chad W. Miller

Enclosure

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: September 12, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Channel Equalization**  
**Serial No.: 10/188,274**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
8/11/02	CWM	Perform review of file and previous drafts as standard procedure to remove prior drafts or notes	0.10 220.00/hr	NO CHARGE
8/21/02	RBR	Draft request for corrected filing receipt.	0.50 120.00/hr	60.00
8/22/02	CWM	Draft letter enclosing filing receipt	0.10 220.00/hr	22.00
8/29/02	CWM	File request for corrected filing receipt	0.10 220.00/hr	22.00
For professional services rendered			0.80	<b>\$104.00</b>
Previous balance				<b>\$899.00</b>
9/5/02 Payment - thank you. Check No. 1726				(\$899.00)
Total payments and adjustments				<b>(\$899.00)</b>
<b>Balance due</b>				<b>\$104.00</b>

In Reference      **Weide & Miller Ref. No.:** SLRFLR.0003P  
To:                    **Subject Matter:** Patent Prosecution  
                         **Title:** Communication System  
                         **Serial No.:** 10/194,775

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
8/29/02	RBR	Draft client letter regarding USPTO receipt of patent application.	0.30 120.00/hr	36.00
		For professional services rendered	<hr/> 0.30	<hr/> \$36.00
		Previous balance		\$808.00
9/5/02		Payment - thank you. Check No. 1726		<hr/> (\$808.00)
		Total payments and adjustments		<hr/> (\$808.00)
		<b>Balance due</b>		<hr/> <hr/> \$36.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
8/7/02	CWM	Review second disclosure tape; revise figures; revise background	4.20 220.00/hr	924.00
8/9/02	CWM	Review prior art in relation to Figure 8	0.40 220.00/hr	NO CHARGE
8/11/02	CWM	Review prior art for reference system of Figure 8; draft introductory portion for precode FEXT cancellation system	0.60 220.00/hr	132.00
8/14/02	CWM	Draft claims direct to communication system and receiver; draft e-mail to G. Zimmerman and W. Jones requesting information	3.90 220.00/hr	858.00
8/16/02	CWM	Continue drafting claims	5.40 220.00/hr	1,188.00
8/27/02	CWM	Review and revise patent application	1.40 220.00/hr	308.00
8/28/02	CWM	Review and revise claims	0.60 220.00/hr	132.00
8/30/02	CWM	Review and revise application; send to client	0.70 220.00/hr	154.00
For professional services rendered			17.20	\$3,696.00
Previous balance				\$2,530.00
9/5/02	Payment - thank you. Check No. 1726			(\$2,530.00)
Total payments and adjustments				(\$2,530.00)
Balance due				\$3,696.00

In Reference      **Weide & Miller Ref. No.:** SLRFLR.0005P  
 To:                **Subject Matter:** Patent Prosecution  
                       **Title:** Method and Apparatus for Constellation Shaping  
                       **Serial No.:** 10/194,741

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
8/22/02	RBR	Draft letter to client indicating receipt of Filing Receipt.	0.50 120.00/hr	60.00
	CWM	Draft request for corrected filing receipt	0.20 220.00/hr	44.00
		For professional services rendered	0.70	<b>\$104.00</b>
		Previous balance		<b>\$3,229.00</b>
9/5/02		Payment - thank you. Check No. 1726		(\$3,229.00)
		Total payments and adjustments		<b>(\$3,229.00)</b>
		<b>Balance due</b>		<b>\$104.00</b>



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In Reference **Weide & Miller Ref. No.: SLRFLR.0009P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Noise Cancellation Based on Transmitter Processing**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
8/8/02	CWM	Revise and supplement patent application	4.60 220.00/hr	1,012.00
8/12/02	CWM	Draft patent application; draft additional figure	4.30 220.00/hr	946.00
8/13/02	CWM	Draft patent application; create figures for method of operation and draft associated text	4.20 220.00/hr	924.00
8/15/02	CWM	Draft claims	2.60 220.00/hr	572.00
8/18/02	CWM	Draft claims	2.60 220.00/hr	572.00
8/20/02	CWM	Draft claims directed to FEXT cancellation in transmitter	3.80 220.00/hr	836.00
8/27/02	CWM	Review and revise patent application	3.70 220.00/hr	814.00
8/28/02	CWM	Review and revise claims	1.70 220.00/hr	374.00
8/30/02	CWM	Review and revise application; draft letter to client enclosing same	1.60 220.00/hr	352.00
For professional services rendered			<u>29.10</u>	<u>\$6,402.00</u>

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Voice: 702-382-4804  
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Date Generated/Mailed: September 12, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Channel Equalization**  
**Serial No.: 10/188,274**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$104.00	\$0.00	\$104.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Communication System**  
**Serial No.: 10/194,775**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$36.00	\$0.00	\$36.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation**  
**Serial No.: Not yet assigned**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$3,696.00	\$0.00	\$3,696.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Constellation Shaping**  
**Serial No.: 10/194,741**

New Fees	New Costs	Total New Charges
\$104.00	\$0.00	\$104.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Multiple Channel Interference Cancellation**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$396.00	\$0.00	\$396.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0009P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Noise Cancellation Based on Transmitter Processing**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$6,402.00	\$0.00	\$6,402.00

Summary For All Matters:

New Fees	New Costs	Total New Charges
\$10,738.00	\$0.00	\$10,738.00

GRAND TOTAL OF ALL AMOUNTS  
 DUE:

\$10,738.00



illustrates an example transceiver system and NEXT and FEXT coupling. As shown a first set of transceivers 104A-104D are part of Station A 102, which is located at a first location. Station A 102 communicates over a channels 108A-108D with a second set of transceivers 112A-112D that are part of Station B 110 and which are  
5 located at a second location. NEXT type crosstalk is shown in Figure 1 by coupling lines 116AB, 116AC, and 116AD with channel 108A as a reference channel. Signals on each of the adjacent channels often couple into the reference channel 108A and thereby interfere with reception of the desired signal. For example, the signal on channel 108A will have NEXT coupling from the signals transmitted onto Channels  
10 108B-108D.

Similarly, the signal transmitted over the reference channel 108A may couple onto the other channels 108B-108D. These coupling signals are shown in Figure 1 as coupling signals 120BA, 120CA, and 120DA. Hence, the processing and decoding of the signals transmitted over channels 108A-108D is made more difficult by the  
15 coupling that occurs between channels.

While attempts have been made to overcome the effects of coupling, none of these attempts adequately reduce the presence or effects of crosstalk. One such attempt is detailed in U.S. Patent No. 6,236,645 issued to Agazzi. The Agazzi reference teaches a cancellation system associated with each receiver in a multi-  
20 receiver system. The cancellation system disclosed in the Agazzi reference may be characterized as utilizing tentative decisions to reduce the effects of coupling onto a reference signal by making assumptions about the reference signal, such as a symbol value, that was sent on the reference channel. The term reference signal and reference

channel as used herein means the signal or channel which is being analyzed, discussed or which is undergoing processing. Any channel within a multi-channel communication system may be designated the reference channel. The tentative decision may be described as a guess regarding a symbol value that was sent on the  
5 channel.

The Agazzi reference does not however, eliminate all of the coupling, and hence, even when adopting the teachings of the Agazzi reference, coupling continues to interfere with isolation of the received signal. One particular drawback to the teachings of the Agazzi reference is that the system of the Agazzi reference suffers  
10 from decision device error resulting from crosstalk corruption of the reference signal. As a result, incorrect decision may occur thereby increasing error rates. Further, the filter proposed for use by the Agazzi reference is undesirably complex due to convolution of the channel response with the coupling response. This undesirably limits processing speeds.

15 Furthermore, prior art solutions often do not address many aspects of coupling signal cancellation. Such aspects include coupling that occurs at frequencies that differ from that of the primary signal and signals that couple into the reference signal yet propagate through the reference channel at rates different from that of the reference signal.

20 The method and apparatus disclosed herein overcomes the drawbacks of the prior art and enables more accurate signal decoding and processing than previously possible. Moreover, transmission at higher data rates with lower error rate, as compared to the prior art, is also enabled.

## SUMMARY

[I will draft the summary after receiving feedback on the other portions of the application]

5    Insert 1 - Last Paragraph of Summary:

*Other systems, methods, features and advantages of the invention will be or will become apparent to one with skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description, be within the*

10   *scope of the invention, and be protected by the accompanying claims.*

## BRIEF DESCRIPTION OF THE DRAWINGS

The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. In the figures, like

15   reference numerals designate corresponding parts throughout the different views.

Figure 1 illustrates a block diagram of an example embodiment of a two station communication system.

Figure 2 illustrates a block diagram of a receiver/transmitter pair.

Figure 3 illustrates a block diagram of an example embodiment a multi-channel

20   point-to-point communication system.

Figure 4 illustrates a block diagram of an example embodiment of a transmitter.

Figure 5 illustrates a block diagram of an example embodiment of a receiver.



Figure 6 illustrates a block diagram of an example embodiment of the receiver shown in Figure 5 in a multi-channel configuration.

Figure 7 illustrates a block diagram of an alternative embodiment of a FEXT cancellation and equalization system described herein.

5        Figure 8A illustrates a block diagram of a receiver having a precode system for coupling cancellation.

Figure 9 illustrates a block diagram of an alternate embodiment of a receiver having a precode system for coupling cancellation.

10       Figures 10A & 10B illustrate operational flow diagrams of an example method of operation.

### **Detailed Description**

In reference to Figure 2, a block diagram of a receiver/transmitter pair is shown. A channel 212 connects a first transceiver 230 to a second transceiver 234. The first transceiver 230 connects to the channel 212 via an interface 244. The  
5 interface 244 is configured to isolate the incoming and outgoing signals. The channel 212 may comprise more than one conductor and hence the interface 244 may perform isolation for each channel based on direction of data flow. The receive module 238 and transmit module 242 may comprise any assembly of hardware, software, or both configured to operate in accordance with the principles described herein.

10 The receive module 238 and transmit module 242 communicate with a processor 246. The processor 246 may include or communicate with a memory 250. The processor operates as described below in more detail and as would be understood by one of ordinary skill in the art. The memory 250 may comprise one or more of the following types of memory: RAM, ROM, hard disk drive, flash memory, or EPROM.  
15 The processor 246 may be configured to perform one or more calculations or signal analysis. In one embodiment the processor 246 is configured to execute machine readable code stored on the memory 250. The processor 246 may perform additional signal processing tasks as described below.

The second transceiver 234 is configured similarly to the first transceiver 230.  
20 The second transceiver 234 comprises an interface 252 connected to a receiver module 256 and a transmitter module 260. The receiver module 256 and a transmitter module 260 communicate with a processor 264, which in turn connects to a memory 268. Operation occurs as described below in more detail.

Figure 3 illustrates a block diagram of an exemplary multi-channel point-to-point communication system. One exemplary application of such as multi-channel communication system is a ten gigabit transceiver utilizing a Category 5 UTP cable supporting Ethernet protocols. As shown, it includes a physical coding sublayer (PCS) 302, 304 shown as coupled together over a channel 312. In one embodiment, each channel comprises twisted pair conductors. Each of the channels 312 is coupled between transceiver blocks 320 through a line interface 306 and each channel is configured to communicate information between transmitter/receiver circuits (transceivers) and the physical coding sublayer (PCS) blocks 302, 304. Although shown with four channels for purposes of discussion, any number of channels and associated circuitry may be provided. In one embodiment, the transceivers 320 are capable of full-duplex bi-directional operation. In one embodiment, the transceivers 320 operate at an effective rate of about 2.5 Gigabits per second.

Figure 4 illustrates a block diagram of an example embodiment of a transmitter. This is but one exemplary embodiment of a transmitter. It is contemplated that other configurations may be embodied by one of ordinary skill in the art. In the exemplary configuration of Figure 4, a data source 400 connects to a mapping module 404, which in turn connects to a precode filter 408.

The data source 400 may comprise any source of data to be transmitted over a channel. In one embodiment, the data source 400 comprises a processing or networking layer of a communication protocol. In one embodiment, the data source 400 comprises a network processing device. In one embodiment, the data arrives from application software executing on a computer.

The mapping module 404 comprises hardware, software, or a combination of both configured to transform the received binary data into one or more symbols capable or representing one or more bits of binary data. One example mapping that may occur is pulse amplitude modulation (PAM), wherein the several bits of binary data are mapped into a single symbol. Another example of mapping comprises quadrature amplitude modulation (QAM). Any type mapping may be utilized. Through mapping, transmission of a single symbol achieves transmission of several bits of information thereby increasing data transfer rates.

In addition to mapping, the mapping module 404 may incorporate forward error correction (FEC) coding. Examples of FEC coding comprise convolutional coding and trellis coding. It is contemplated that the method and apparatus described herein may be utilized with any form of error correction, or without error correction.

The precode filter 408, which is discussed below in greater detail, connects to the output of the mapping module 404 and comprises a signal modification device configured to manipulate the signal to counter the distorting effects of the channel. The precode filter 408 may be configured as a digital filter having coefficient values set to achieve a desired level of signal modification. In one embodiment the precode filter 308 comprises a finite impulse response filter adapted to at least partially negate the distorting effects of a channel. Selection of precode filter coefficients is discussed below in more detail.

The output of the precode filter 408 connects to a digital to analog (D/A) converter 412 to transform the mapped signal to an analog format suitable for transmission through a channel. Thereafter, the signal is provided to a line

driver/amplifier 416. The line driver/amplifier 416 manipulates the signal to a power level suitable for transmission over the channel. The degree or level of amplification may be dependant upon the power limits or specification as defined by a particular communication protocol, crosstalk and coupling concerns, and the distance to a receiver or a repeater. The output of the line driver/amplifier 416 connects to a transformer/hybrid 420. The transformer/hybrid 420 provides isolation between transmit and receive signals as well as the channel itself. The output of the transformer/hybrid 420 connects to a channel.

Prior to discussion of further embodiments, additional discussion of far end crosstalk (FEXT) is warranted. An aspect FEXT known as equal level FEXT (ELFEXT) is of importance to coupling cancellation. ELFEXT comprises the equivalent coupling at the far end of the channel measured with respect to an attenuated transmit signal. Removing FEXT is made difficult because FEXT is dependant on the length of the channel and since at least a portion of the FEXT signal couples at the far end of the channel. As a result, the FEXT is also subject to ISI and attenuation at it passes through the reference channel. Considering FEXT as ELFEXT takes into consideration the effects of the channel, including the length of the line. Prior art solutions did not adequately address such aspects. Through consideration of this and other aspects a more complete coupling cancellation system and method may be realized.

Figure 5 illustrates a block diagram of an example embodiment of a receiver having coupling cancellation components. This is but one possible receiver configuration that may adapt the principles described herein incorporate. It is

contemplated that other receiver configurations may be enabled without departing from the scope of the invention. As shown, the receiver 500 comprises an amplifier 504 configured to receive a signal arriving over a channel. The amplifier 504 increases the power level or voltage of the received signal, which may have been  
5 attenuated by transmission through the channel. The amplified signal feeds into an analog to digital (A/D) converter 508, which in turn provides a digital signal,  $rx(n)$ , to a feed forward equalizer (FFE) 512. The output of the FFE,  $x(n)$ , connects to a summing junction 516. The term summing junction and subtractor are used interchangeably herein. The FFE 512 may be configured to reduce intersymbol  
10 interference. It is contemplated that one of ordinary skill in the art is capable of FFE 512 construction and familiar with basic FFE operation. Accordingly, the basic principles of FFE operation are not discussed in detail herein beyond that associated with the new and distinctive features of the invention. It is further contemplated that filter or equalizer structures, other than an FFE 512, may be utilized without departing  
15 from the scope of the invention.

The summing junction 516 also receives an input from a decision feedback equalizer (DFE) 524. The DFE 524 may be configured to reduce intersymbol interference. In one embodiment, the summing junction 516 subtracts the DFE output from the FFE output. The summing junction 516 provides its output,  $s(n)$ , to a  
20 decision device, such as a slicer 520. The slicer 520 comprises any device capable of analyzing a received signal and quantizing the received signal to two or more distinct values. In one embodiment, the slicer 520 operates in conjunction with PAM10 mapping to quantize the input  $s(n)$  to one of ten values. In one embodiment, the slicer

520 analyzes the received signal's voltage level, after processing, to determine the symbol sent over the channel. The output of the slicer 520 may comprise binary data or mapped voltage levels.

In this example embodiment, the slicer 520 provides its output to a demapping and error correction module 528, the DFE 524 and a second summing junction 530. Demapping and error correction decoding are understood by those of ordinary skill in the art, and hence module 528 is not discussed in detail. The error correction processing, as part of the forward error correction, reduces the effective error rate of the data signal. Forward error correction may occur on binary data or symbols.

It is contemplated that one of ordinary skill in the art is capable of DFE 524 construction and familiar with basic DFE operation. Accordingly, the basic principles of DFE operation are not discussed in detail herein beyond that associated with the new and distinctive features of the invention. It is further contemplated that other filter or equalizer structures, other than an FFE 512 or DFE 524 may be utilized without departing from the scope of the invention. Although not shown, it is also contemplated that one or more delays may be utilized as necessary and as would be understood by one of ordinary skill in the art.

The FFE 512 and the DFE 524 perform equalization on the received signal to compensate for the distorting effects of the channel. The DFE 524, as part of the feedback, receives and weights past values, which are subsequently subtracted, in the summing junction 516, from the arriving signal. It is contemplated that the FFE 512 and DFE 524 may possess coefficients, or other scaling values, associated with one or

more taps or stages of the FFE and the DFE. The coefficient values are selected to achieve desired signal equalization to thereby negate, reverse, or reduce the effects of the channel. In one embodiment the FFE 512 and DFE 524 coefficient value are selected based on the principles described herein. In one embodiment, the coefficient values are arrived at using a least mean squared algorithm. In one embodiment, the coefficient values of the FFE 512, DFE 524, and the precode filter (element 408, Figure 4) are calculated and selected to counter the signal distorting effects of the channel while minimizing noise amplification and minimizing the undesirable effects of error propagation through the DFE feedback loop.

The output of the DFE 524 is also provided to a subtractor 530 where it is combined with the output of the slicer 520. The output of the subtractor 530 is provided to a FEXT filter 534. The FEXT filter 534 may comprise any type filter, including a digital filter, analog filter or combination thereof. It is also contemplated that the filtering may occur in software or hardware or both. In one embodiment, FEXT filter 534 is trained to have a transfer function of  $\hat{A}$ , where  $\hat{A}$  comprises the transfer function that is or is similar to the ELFEXT coupled signal. Thus, the FEXT filter 534 is trained to have a transfer function that approximates the ELFEXT components that are coupled into the reference signal. The output of the FEXT filter 534 is provided to other transceivers in a multi-channel communication system so that the ELFEXT components may be removed from the other channels in the multi-channel communication system. As more clearly illustrated in Figure 6, the FEXT filter 534 forms a feedback loop with the other transceivers. Application of the principles of the embodiment of Figure 5 is discussed below in more detail.



In operation, the system of Figure 5 operates, in conjunction with other transceivers, to receive and process a signal received over one of two or more channels. The use of subtractor 530 and FEXT filter 534 provide the advantage of isolating the ELFEXT component in the received signal.

5       As discussed above, one complex aspect of FEXT cancellation is that the equalization processes and the FEXT cancellation are often combined. Because of the complexity in equalization and FEXT cancellation, this process becomes undesirably complex and can require filters of unrealizable size, complexity, or of limited speed. As can be seen in Figure 5, the output of the slicer comprises a decision output that is  
10       quantized to one of two or more predetermined values. Due to the feedback properties of the DFE 524, the DFE is optimized to account for the ISI aspects. The output of the DFE 524 is provided as an input to the subtractor 530. Thus, the output of the subtractor 530 may be considered to have had the unwanted ISI components removed from the slicer output. As a result, the construction of the FEXT filter 534  
15       need only be concerned with reduction of remaining FEXT components. By separating the processing into two processing elements, i.e. elements 512, 524 and element 534, the complexity of each element is reduced as compared to systems of the prior art which realized the ISI reduction and FEXT cancellation in a single processing unit. Hence, the coefficients of FEXT filter 534 are selected to deal with  
20       the FEXT components. As a result, the FEXT filter 534 may be made less complex than a filter attempting to perform both equalization and FEXT cancellation. For example, the length, i.e. the number of taps, of the required filters is reduced.

Stated another way, prior art systems that utilize a signal processing element, such as a filter, to remove both the ISI and the FEXT would in effect perform a convolution of the coefficients of the DFE 524 and the FEXT filter 534. However, as an advantage of the method and apparatus described herein, the cascode (**cascade?**) configuration of these two filters eliminates the need for the convolution thereby eliminating a complex and computationally costly process.

Considering the embodiment shown in Figure 5, the DFE filter 524 is trained to have a transfer function of  $1-B'(z)$  where  $B(z)$  is the transfer function of the channel. The ELFEXT is defined at  $A(z)$ . As a result, The transfer function of the the channel when considering FEXT coupling is  $A(z)$  convolved with  $B(z)$ . If enabled in a single filter, an underably complex and undirably large filter would be required.

Based on the teaching contained herein, the processing may be simplified by configuring the FEXT filter 534 to have a transfer function of  $\hat{A}(z)$  and be configured and trained to approximate the ELFEXT on the channel with which the FEXT filter 534 is associated. Thus,  $\hat{A}(z)$  may be defined to be an estimate of the FEXT on the line. In general terms, the component B results from the line, i.e. the ISI component, while the  $\hat{A}$  component results from the FEXT. Through the **cascade** of the FEXT filter 534 and the DFE 524, the complexity of each filter is greatly reduced.

In one embodiment, the FEXT filter 534, in conjunction with the other elements of the receiver, is defined as convolution of  $B(z)$  with  $\hat{A}(z)$ . As a result, the signal  $y(z)$  may be defined as  $x(z)\hat{A}(z)B(z)$  which is the desired FEXT cancellation function. **[Inventors, this is from my notes, but it may need work. Please edit as appropriate** \_\_\_\_\_

\_\_\_\_\_.] Thus, in general terms, it is desired to adaptively train a FEXT canceller and provide the output signal of a FEXT canceller as an input at an appropriate place in the other receiver structures in a multi-channel communication device to cancel the FEXT components on the other channel. It is contemplated that this process operates in both directions in a bi-directional communication system to thereby provide positive feedback to each transceiver.

Figure 6 illustrates a block diagram of an example embodiment of the receiver shown in Figure 5 in a multi-channel configuration. As compared to Figure 5, similar elements are labeled with identical reference numerals. As shown, input signal 604A-604M, where M is any positive integer, are received over a multi-conductor communication system having M number of channels. The channels may comprise any medium capable of carrying a signal or data, such as but not limited, CAT5 cabling, wireless channels, fiber optic channels or cables, free-space optic channels, twisted pair conductors or any other conductive path, coaxial cables or other channels that are currently or that may become available in the future. Although shown with four channels, it is contemplated that the principles described herein may be expanded to any number of channels.

Operation of elements 512, 516, and 524 occur as described above in conjunction with Figure 5. Additional filters 534 are included as shown to account for the multi-channel configuration. Although not shown with connecting lines, the output of each filter 534 is routed as an input to a summing junction 610 of each

receiver to which FEXT coupling may occur. Accordingly, the output of each of the filters 534 is routed to an appropriate one of the summing junctions 610 to thereby cancel unwanted coupling. By way of example, the output of the filters 534AB generates an output  $A'_B$  that is provided as an input to the summing junction 610B of the second channel, in this case channel B. In one embodiment, the receiver associated with channel A provides an FEXT cancellation signal to each of the other receivers in the multi-channel communication system. Hence, the filters 534AC, 534AD also generate outputs  $A'_C$  and  $A'_M$  respectively, which are provided to the summing junctions 610 of the channel C receiver and the channel  $M^{\text{th}}$  receiver as shown. This process occurs for each of the filters 534 as shown. The output of the filters 534 may comprise the FEXT cancellation signal. As a result, the subtractors 516 remove the FEXT components that were isolated by the other receivers. This occurs for each channel, as shown, and thus removes the FEXT components that coupled on to each channel from the other channels.

It is contemplated that one or more of the coefficients of the filters 534 may be set to zero or other nominally small value. If the computations that must be performed may not occur in a single cycle, then one or more of the initial coefficients may be set to zero or other nominally small value. [\_\_\_\_\_

\_\_\_\_\_ -

\_\_\_\_\_. I believe I missing something here. Please assist with this part or delete.]

As discussed, one advantage to the method and apparatus disclosed by Figures 5 and 6 is that each FEXT filter may be made less complex than in systems of the prior

art because the FEXT filter adapts to the transfer function of the FEXT on the channel instead of having to adapt for both the FEXT cancellation and equalization. As can be seen in Figure 6, each receiver includes a feedforward filter 512 and a feedback filter 524 to perform equalization. Thus, the existing equalization structure of each receiver performs equalization, thereby requiring that the FEXT filter only adapt to the FEXT components for the channel to which the FEXT filter is feedback. Design and operation of a filter or other cancellation device configured to isolate only the FEXT components, as compared to the combined FEXT and equalization tasks is less complex. Consequently, distributing the processing burden between the filters as shown improves performance and reduces complexity of both the FEXT cancellation systems and the equalizer systems.

Another advantage is that in one embodiment a unique filter is utilized for FEXT component isolation for each channel in a multi-channel communication system. For example, instead of a receiver having a complex filter to cancel all the FEXT components that couple onto the channel, the method and apparatus disclosed herein utilizes a FEXT filter in each receiver to isolate a FEXT cancellation signal and distribute each FEXT cancellation signal to each of the other receivers. This further reduces the processing requirements and complexity of a multi-channel communication system.

It is contemplated that the filter coefficients, and in particular the coefficients of FEXT filter 534, may be established in any manner known in the art. Thus, the coefficients may be established during an initial training period or set at default value during manufacture. In one embodiment, the least mean square algorithm is utilized

to train or adapt the FEXT filters. It is further contemplated that the filter coefficients may be updated during system operation to thereby adapt to changing channel or environmental conditions. In one embodiment, training of the FEXT filter occurs while the filter is separate from the channel, such as when the channel is not  
5 transmitting data and the effects of FEXT may be isolated.

Figure 7 illustrates a block diagram of an alternative embodiment of the FEXT cancellation and equalization system described herein. As compared to Figure 5, similar elements are identified with identical reference numerals. Accordingly, only aspects of Figure 7 that differ from Figure 5 are discussed in detail. As shown the  
10 output of the FEXT filter 534 feeds into a delay element 704 and a subtractor 712. The subtractor 712 subtracts the output of the FEXT filter 534 from the output of the feedback filter 524 as shown and the resulting signal is provided to the subtractor 516. The subtractor 516 subtracts the resulting signal from the output of the feedforward filter as shown.

15 The output of the delay 704 connects to a summing junction 708 where it is combined with the output of the decision device 520. The summing junction 708 provide the combined signal to the feedback filter 524.

In operation, the system of Figure 7 generates the FEXT signal that is generated by the signals transmitted through the first channel 702A so that they may  
20 be removed from the other channel(s) in the communication system. Thus, the output of the FEXT filter 534A comprises the FEXT components from the channel 702A that couple onto channel B 702B. This signal is provided to the feedback filter 524B so that the feedback filter may account for this aspect of the received signal when

equalizing the signal received over the second channel 702B. A delay 704A is utilized to account for delays that occur in the feedback filter or delays that may be necessary in the processing chain due to different rates of propagation of the signals through the multiple channels of the communication system. It is contemplated that  
5 in other embodiments other amounts of delay may be introduced, or that delay may be introduced at locations other than that shown in Figure 7.

The output of the FEXT filter 534A that is provided to the subtractor 712B is eventually removed from the received signal, in this embodiment by subtractor 516B. In this manner, the FEXT components from one more channels may be subtracted  
10 from the signals received on the other channels. The advantages discussed above with regard to figures 5 and 6 are also realized with this embodiment.

Also shown is the FEXT cancellation system 534B, 704A, and 712A for the first channel. This system is generally similar to the system described above and hence is not described again. Through use of this feedback system the coefficients in  
15 filters 534 are selected to generate a FEXT cancellation signal that is feedback to the other receivers.

Although shown for purposes of discussion and understanding as a two channel, and hence a two receiver system, it is fully contemplated that the system and principles of Figure 7 may be applied to any number of receivers in a multi-channel  
20 communication system to remove the FEXT coupled onto each channel. In a similar manner shown in Figure 6, the output of the filter may be provided to a structure as shown in Figure 7 to provide an inter-channel FEXT removal signal to each of the other receivers in a multi-receiver communication system.

It is understood that feedback based FEXT cancellation may best occur when the signals to be subtracted or removed from a received signal are present at one of the other receivers in a multi-receiver communication system. For example and in reference to Figure 6, to generate the cancellation signals provided to input 640 to  
5 cancel the FEXT from the signal received on input 604B requires that the signals  $A'_B$ ,  $C'_B$ , and  $M'_B$  have been received and processed by the filters 534AB, 534CB, 534MB respectively. Thus, there may be a feedback arrangement between receives of the multi-receiver communication device. As stated above, the term reference is used to designate which signal or channel of a multi-channel communication system is  
10 undergoing FEXT cancellation. By way of example, when the signal of interest that is received over input 604B is undergoing FEXT cancellation, then this signal would be designated the reference signal and input 604B designated as the reference input or reference channel.

**[Will the principles of this invention apply to NEXT or ECHO  
15 Cancellation also?]**

In some instances, the signals required to generate the FEXT cancellation signal do not arrive concurrent with or prior to the arrival of the FEXT signals that are coupled onto the reference signal. For example, the signals that are required to generate the FEXT cancellation signal are the signals that are transmitted on the  
20 channels other than the reference channel. Hence, if all of the signals have not arrived, FEXT cancellation may not be possible. Such differences in arrival time may occur because FEXT coupling may propagate through the channel at a different rate than the signal of interest. In addition, some channels in a multi-channel



communication system are different lengths, thereby causing the signals to arrive at different times relative to a common transmit time.

As a result, some FEXT coupling may be present as a component of the reference signal even though the signal that generated the coupling has not yet arrived at the reference receiver. This portion of the FEXT coupling may be referred to as the non-causal portion of the FEXT. In contrast, the causal portion of the FEXT may be defined as the FEXT components that arrive with or after the arrival of the signal that generated the FEXT. Failure to account for the different arrival rate of FEXT components, i.e. the non-causal FEXT components, may hinder operation of the FEXT cancellation system. This is especially true as data communication rates increase since timing become more critical and each processing step must be completed within constrained time limits. The method and apparatus disclosed herein overcomes this challenge associated with FEXT cancellation by incorporating FEXT cancellations operations in the transmitter side of the communication system.

While it is contemplated that numerous filtering or FEXT cancellation systems may be incorporated into the transmitter, in one embodiment a FEXT precode filter is tailored to perform FEXT cancellation. The term precode filter as used herein is defined to mean a filter located in the transmitter. Use of a precode filter in a role unrelated to FEXT cancellation is shown in Figure 4. In general, one or more FEXT precode filters may be located in one or more of the transmitters in a multi-channel communication system and may be trained to have a transfer function that will reduce or eliminate a portion of the FEXT coupling. Use of a precode filter allows the transmitter to remove a portion of the FEXT coupling prior to transmission and

thereby deal with the non-causal aspects of the FEXT, that is, the FEXT coupling that arrives on the reference channel after the arrival of that portion of the signal that generated the coupling.

In one embodiment, precoded FEXT cancellation comprises measuring the FEXT response for a channel at the receiver and dividing by the impulse response of the line to obtain the FEXT precode filter coefficients. In another embodiment, the FEXT precode filter is trained using reference based training. In yet another embodiment, the filter coefficients are derived by training the filters associated with only one channel at a time.

In one embodiment, all or a portion of the FEXT cancellation is performed by a precode filter such that the FEXT precode filter isolates the FEXT transfer function for each of the other channels in a multi-channel communication system and provides its output to each of the other transmitters. The precode FEXT cancellation signal, which is generated by the FEXT precode filter, is combined with the signals being transmitted on the other channels prior to transmission. This may occur for each transmitter in a multi-channel communication system. The coefficients for the FEXT precode filter may be established by processing that occurs in the transmitter or processing that occurs in the receiver.

Figure 8 illustrates a block diagram of an example embodiment of a transmitter configured with a precode FEXT filter system. As compared to Figure 3, similar elements are identified with identical reference numerals. This example embodiment is configured as a three channel communication device, however, it is

contemplated that in other embodiments the principles may be extended to any communication system having two or more channels.

As shown in this embodiment, the output of the first precode filter 308 is directed not only to a summing junction 808, but also to one or more precode FEXT filters 812, 816. The precode FEXT filters 812, 816 process this input to generate a precoded FEXT cancellation signal that is fed back to summing junctions 808 in the other transmitters of a multi-channel communication system. For example, the precode FEXT filter 812A generates a precoded FEXT cancellation signal designated  $A'_B$  that is routed as an input to the summing junction 808B via input 820B. Likewise, the output of a precode FEXT filter 816A generates an output  $A'_C$  that is provided on input 820C to summing junction 808C. The precoded FEXT cancellation signals  $A'_B$  and  $A'_C$  may be subtracted from the signal that are to be transmitted over channel B and channel C. Subtracting the precoded FEXT cancellation signals  $A'_B$  and  $A'_C$  cancels the FEXT that will be generated by the signal traveling over channel A and that will couple onto channel B and channel C. This configuration repeats with the other transmitters associated with the one or more other channels. Hence, input 820A provides precode FEXT cancellation signals that are generated by the other transmitters to the channel A transmitter.

In one embodiment, the precode FEXT filters located in the two or more transmitters operate in conjunction with the FEXT filters described above that are located in the receivers. In such an embodiment, a portion of the FEXT cancellation may occur in the transmitter and a portion may occur in the receiver. In one configuration, one or more of the FEXT filter coefficients of the receiver FEXT filter

are set to zero or other nominal value. It is contemplated that these coefficients comprise the coefficients that account for the non-causal portion of the FEXT coupling as seen by the receivers. Hence, the precode FEXT filter may be considered a non-causal filter.

5           Stated another way, to account for the FEXT coupling on the reference signal that arrives prior to the arrival, at the other receivers of the signals that generated the FEXT coupling, certain aspects of FEXT cancellation are transferred to the precode FEXT filter. In one embodiment, the aspects of FEXT cancellation that are transferred to the precode FEXT filter comprise those aspects that cancel non-casual  
10 FEXT. This occurs, because, non-causal FEXT is considered to arrive on the reference signal prior to the arrival, at other receivers in the multi-channel communication system, of the signals that generate the FEXT coupling. Hence, the duties performed by one or more coefficients of the receiver FEXT filter may be transferred to the precode FEXT filter. As a result, certain coefficients of the FEXT  
15 filters located in the receiver may be set to zero. In one embodiment an identical number of coefficients values are transferred from the receiver FEXT filter to the precode FEXT filter. Although any number of coefficients values may be set to zero, in one embodiment \_\_\_\_\_ receiver filter coefficients are set to zero. The number of coefficients may range from zero to \_\_\_\_\_.

20           The precode FEXT filters 812, 816 may comprise any type of filter capable of manipulating an input signal to generate a FEXT cancellation signal. In one embodiment the precode FEXT filter 812, 816 comprises an adaptive digital filter, such as but not limited to a finite impulse response filter \_\_\_\_\_

\_\_\_\_\_. The precode FEXT filters 812, 816 may comprises either a transposed or transversal configuration, or any other configuration. The filters 812, 816 may be of any size. In one embodiment, the filters range form \_\_\_\_ to \_\_\_\_ tops.

5 In an alternative embodiment, shown in Figure 9, the precode FEXT filters are located before the standard precode filter 308 as shown. This configuration achieves the advantage of \_\_\_\_\_. It is contemplated that one of ordinary skill in the art may arrive at other configurations that do not depart from scope of the claims that follow.

10

Figure 10A and 10B illustrate an operational flow diagram of an example method of operation of one embodiment of the invention. The method of operation shown in Figure 10A and 10B encompasses operation of a system having the precode FEXT cancellation and receiver FEXT cancellation capability. It is contemplated however, that other embodiments may implement only one of these types of FEXT cancellation without departing from the scope of the invention. In reference to Figure 10A, at a step 1004, a reference transmitter at a first station receives a reference signal from a signal source. It is contemplated that the reference transmitter comprises a transmitter, which is the focus of this discussion, and the term reference is utilized to distinguish it from the other transmitters in a multi-transmitter communication system. The reference signal is utilized to generate FEXT cancellation signals, which are subtracted from the signal processed by the other transmitters.

15

20

Next or concurrently, at a step 1106, the other transmitters in the multi-transmitter communication system receive signals that are to be transmitted to a second station. Thus, multiple signals may be simultaneously transmitted over two or more channels. Thereafter, at a step 1008, the reference transmitter directs the  
5 reference signal to one or more precode FEXT filters to generate FEXT cancellation signals. The operation and configuration of the precode FEXT filters is discussed above and thus is not discussed again. It is contemplated that the number of precode FEXT filters may correspond to the number of channels. Thus, a four channel communication system would comprise four transmitters and four receivers at each  
10 station. In such an embodiment, the reference signal would be provided to each of three precode FEXT filters.

Thereafter, at a step 1012, the precode FEXT filter processes the reference signal to generate FEXT cancellation signals. In one embodiment, a unique FEXT cancellation signal is generated for each of the other channels while in another  
15 embodiment a single signal is generated for use by each channel. In one embodiment, processing by the precode FEXT filter comprises generating a signal that has a transfer function generally equivalent to the non-causal portion of the FEXT which will couple onto the other channels to which the particular precode FEXT filter output will be provided. [ \_\_\_\_\_  
20 \_\_\_\_\_  
\_\_\_\_\_. **Correct ??**] Operation of a digital filter is generally understood by one of ordinary skill in the art and hence is not discussed in detail here.

At a step 1016, the outputs, that comprises FEXT cancellation signals, of each precode FEXT filter of the reference transmitter are routed to the appropriate transmitter in the multi-channel communication system. As shown, in Figure 6 the transmitter associated with channel A includes a precode FEXT filter configured to generate a FEXT cancellation signal directed to each of the other transmitters. Each FEXT cancellation signal is tailored to cancel the non-casual portion of the FEXT signal that will couple onto the respective channel to which the cancellation signal is provided.

At a step 1020, the FEXT cancellation signals that are routed to each respective transmitter are subtracted from the signal processed by the respective transmitter. As result of subtracting the FEXT cancellation signal from each of the signals on the other channels in the transmitter, the non-causal FEXT coupling is canceled prior to transmission. This provides the advantage of canceling the FEXT coupling that the FEXT filters located in the receiver would be unable to remove.

Next, at step 1024, this process is repeated in the reference transmitter. Hence, the reference transmitter receives one or more cancellation signals from the other transmitters in the multi-transmitter communication system. At a step 1028, these FEXT cancellation signals are subtracted from the reference signal. As a result, a portion of the FEXT that would otherwise couple onto the reference signal as it passes through the channel is canceled in advance of its coupling, i.e. prior to transmission of the reference signal. Thereafter, at a step 1032, the two or more transmitters transmit the reference signal and the other signals via the multiple channels to the receivers at a second station .

At a step 1036, the reference signal and the other signals are received at the receivers of the second station. The precode filter FEXT cancellation may only cancel a portion of the FEXT that couples onto the signals as they pass through the channel. Consequently, additional FEXT cancellation may improved signal decoding.

5 Accordingly, at a step 1036, the cancellation process of this embodiment processes the received reference signal to generate a processed reference signal. The processing may comprise any type of processing that occurs in a receiver. In one embodiment, the processing comprises processing to reduce or eliminate intersymbol interference. **[Is there a broad term for this type of processing. This seems important since in**  
10 **general, a first type processing is combined with FEXT filtering to reduce FEXT filter complexity.]** In other embodiments, \_\_\_\_\_ type processing may occur. As an advantage to the method of operation of this embodiment, the \_\_\_\_\_ processing reduces the computational burden of the FEXT filtering. It is contemplated that the processing of step 1036 may occur prior to or after FEXT  
15 filtering.

Turning now to Figure 10B, at a step 1040 the processed reference signal is provided to one or more FEXT filters that are located in the reference receiver. As shown in Figure 6, a FEXT filter may exist and be configured to generate a FEXT cancellation signal tailored to cancel the FEXT from the reference signal that coupled  
20 onto the signals arriving on each of the other receivers. At a step 1044, the one or more FEXT filters manipulate the processed reference signal to generate one or more FEXT cancellation signals. In one embodiment, each FEXT filter generates a FEXT cancellation signal that is routed to one of the other receivers. At a step 1048, the



FEXT cancellation signals, generated from FEXT filtering the reference signal, are distributed to each of the other receivers in the second station. Thereafter, at a step 1052, the system subtracts the FEXT cancellation signal from the signal being processed by each respective receiver to thereby cancel the remaining FEXT that has  
5 coupled onto the line and which was not already cancelled by the precode FEXT. In one embodiment, canceling the remaining FEXT comprises canceling the casual portion of the FEXT coupling.

At a step 1056, this processes is repeated for the reference receiver. Thus, one or more FEXT cancellation signals from the other receives in the second station are  
10 routed to the reference receiver and, at a step 1060, these signals are subtracted from the reference signal. In one embodiment, the subtraction of the cancellation signals occurs prior to the processing described in step 1036. In other embodiment, the subtraction may occur after processing. At a step 1064, the reference signal and the other received signals may be output from the receivers of the second station for  
15 subsequent processing. It is contemplated that this method of operation may occur continuously to cancel FEXT coupling during data transmission between the first station and the second station.

While various embodiments of the invention have been described, it will be apparent to those of ordinary skill in the art that many more embodiments and  
20 implementations are possible that are within the scope of this invention.

## CLAIMS

What is claimed is:

1. A multi-channel communication system having a first station and a  
5 second station configured to communicate over two or more channels comprising:  
a first station having two or more transmitters configured to send two or more  
transmitted signals over two or more channels from the first station to the second  
station;  
a second station having two or more receivers configured process a received  
10 signal, wherein each received signal comprises the transmitted signal and a coupling  
signal and wherein at least one receiver comprises:  
a decision device configured to generate a decision output based on at  
least the receive signal and a modified decision output;  
a feedback system configured to generate a modify decision output and  
15 combine the modified decision output, the received signal, and one or more incoming  
cancellation signals;  
a subtractor configured to subtract the modified decision output from  
decision output to create a third signal; and  
a processing system configured to process the third signal to create one  
20 or more outgoing cancellation signals.
2. The system of Claim 1, wherein the communication system is further  
configured to transmit data from the second station to the first station.
3. The system of Claim 1, wherein the one or more incoming cancellation  
25 signals comprise one or more cancellation signals configured to remove FEXT  
coupling from the received signal.

4. The system of Claim 1, wherein the subtractor is further configured to subtract the modified decision output and one or more incoming cancellation signals from decision output to create the third signal.

5 5. The system of Claim 1, wherein the processing system comprises two or more FEXT filters.

6. The system of Claim 1, wherein each receiver generates a unique cancellation signal tailored for each of the other receivers.

10

7. The system of Claim 1, wherein the feedback system comprises a decision feedback filter.

8. The system of Claim 1, wherein the decision device comprises a slicer.

15

9. The system of Claim 1, wherein the multi-channel communication system comprises a four channel communication system configured to operate in accordance with an Ethernet Communication Standard.

20 10. The system of Claim 1, wherein the two or more transmitters of the first station further comprises two or more FEXT precode filters configured modify the two or more signals prior to transmission to cancel FEXT coupling.

25 11. The system of Claim 10, wherein each transmitter includes one or more FEXT precode filters configured to generate and provide one or more precode cancellation signals to other transmitters.

30

12. A multi-channel communication system configured to reduce noise comprising:

one or more transmitters configured to transmit a first signal on a first channel and a second signal on a second channel; and

5 a first receiver configured to receive a third signal on the first channel and a second receiver configured to receive a fourth signal on the second channel, wherein the third signal comprises the first signal and a first noise component and the fourth signal comprises the second signal and a second noise component wherein;

the first receiver further comprising:

10 a first feedback filter loop configured to receive the third signal and reduce noise on the third signal, the output of the first feedback filter loop comprising a first feedback filter loop output;

a first device configured to receive a second cancellation signal from the second receiver and combine the second cancellation signal with the first feedback filter loop output to create a first device output;

15 a first filter configured to receive the third signal and the first device output and generate a first cancellation signal; and

the second receiver further comprising:

20 a second feedback filter loop configured to receive the fourth signal and reduce noise on the fourth signal, the output of the second feedback filter loop comprising a second feedback filter loop output;

a second device configured to receive the first cancellation signal from the first receiver and combine the first cancellation signal with the second feedback filter loop output to create a second device output;

25 a second filter configured to receive the fourth signal and the second device output and generate the second cancellation signal.

13. The system of Claim 12, wherein the first device and the second comprise a summing junction.

30

14. The system of Claim 12, wherein the first and second feedback filter loops comprise a decision device and a decision feedback filter configured to reduce intersymbol interference.

5 15. The system of Claim 12, wherein the multi-channel communication system has four channels.

16. The system of Claim 12, wherein the first filter configured to receive third signal and the second filter configured to receive the fourth signal comprise  
10 digital filters having coefficient values selected to generate cancellation signals that cancel FEXT coupling.

17. The system of Claim 12, wherein the one or more transmitters further  
15 comprise precode filters.

18. The system of Claim 12, wherein at least one of the one or more transmitters is configured to generate an outgoing precode cancellation signal and receive an incoming precode cancellation signal from another transmitter.

20 19. A receiver for use in a multi-channel communication system to cancel FEXT that has coupled onto a transmitted signal and reduce intersymbol interference that is distorting the transmitted signal, a distorted version of the transmitted signal and FEXT coupling comprising a combined signal, the receiver comprising:

25 a first device configured to receive and subtract a feedback signal and one or more received cancellation signals, received from other receivers, from the combined signal to create a decision device input signal;

a decision device configured to process the decision device input signal to generate a discrete output;

30 a decision feedback equalizer configured to receive and process the discrete output to generate an equalizer output;

a second device configured to combine the equalizer output and the one or more received cancellation signals to create the feedback signal;

a third device configured to subtract the feedback signal from the discrete output; and

5 one or more FEXT filters, each configured to generate a cancellation signal tailored to cancel FEXT coupling on another channel in the multi-channel communication device.

20. The receiver of Claim 19, wherein the first, second, and third devices  
10 comprise subtractors.

21. The receiver of Claim 19, wherein the decision device comprises a ten output level slicer.

15 22. The receiver of Claim 19, wherein a station in the communication system comprises four receivers.

23. The receiver of Claim 19, further comprising a first filter configured to process the combined signal to reduce intersymbol interference on the combined  
20 signal.

24. A receiver in a multi-receiver system configured to receive two or more signals via two or more channels, each respective receiver comprising:

an input configured to accept a received signal;

25 a decision device configured to quantize a decision device input signal to one of two or more decisions values, the decision device input signal based on the received signal;

a first filter configured to process the decision values to create a first filtered signal;

one or more FEXT filters configured to processes the decision values and the first filtered signal to create a cancellation signal tailored to cancel coupling on one or more other channels;

one or more devices configured to:

5                   receive one or more cancellation signals from other receivers in the multi-receiver system; and

                  process the cancellation signals and the received signal received to cancel unwanted coupling in the received signal.

10           25.    The receiver of Claim 24, wherein the first filter comprises a digital filter configured to reduce intersymbol interference.

                  26.    The receiver of Claim 24, wherein the decision device quantizes the decision device input signal to any one of ten values based on a comparison to  
15   predetermined thresholds.

                  27.    The receiver of Claim 24, wherein the one or more FEXT filters comprise digital filters having two or more coefficients and the one or more FEXT filters and the first filter are configured to cancel coupling and reduce intersymbol  
20   interference.

                  28.    The receiver of Claim 24, further comprising a second filter configured to process the received signal to reduce intersymbol interference.

25           29.    The receiver of Claim 24, wherein the one or more devices comprise one or more summing junctions.

                  30.    A method for reducing noise in a multi-channel communication system having two or more receivers and two or more channels comprising:

receiving a first signal on a first channel with a first receiver and a second signal on a second channel with a second receiver;

combining a feedback signal with the first received signal to create a first combined signal;

5        processing the first combined signal to reduce interference in the first combined signal to create a processed signal, the interference created by passage of the first signal through the first channel;

combining the processed signal with at least a first cancellation signal received from at least the second receiver to create a feedback signal;

10       combining the feedback signal with the processed signal to create a second combined signal;

processing the second combined signal to generate at least a second cancellation signal.

15       31.    The method of Claim 30, wherein the combining a feedback signal with the first received signal cancels FEXT coupling in the first received signal.

32.    The method of Claim 30, wherein processing the first combined signal comprises performing decision feedback equalization on the signal to reduce  
20    intersymbol interference.

33.    The method of Claim 30, further comprising quantizing the first combined signal with a decision device to create the first combined signal.

25       34.    The method of Claim 30, wherein the second receiver is configured similarly to the first receiver and the second receiver generates the first cancellation signal and receives the second cancellation signal from the first receiver.

35.    The method of Claim 30, further including delaying the first  
30    cancellation signal to achieve proper timing.



36. A receiver for FEXT cancellation in a multi-channel communication system comprising:

5 a feedback loop comprising:

a first device configured to combine a received signal with a feedback signal and an one or more incoming cancellation signals to create a combined signal;

a decision device configured to process the combined signal to generate a decision output;

10 a first filter configured to generate a feedback signal based on the decision output and the one or more incoming cancellation signals or a delayed version of the one or more incoming cancellation signals, wherein the one or more incoming cancellation signals are received from one or more other transmitters in the multi-channel communication system; and

15 one or more FEXT filters configured to receive the decision output and generate one or more outgoing FEXT cancellation signals which are routed to other receivers in the multi-channel communication system.

37. The receiver of Claim 36, wherein the first device comprises a subtractor or summing junction.

38. The receiver of Claim 36, wherein the decision output comprises a signal that has undergone the FEXT cancellation.

25 39. The receiver of Claim 37, further comprising a feedforward filter configured to process the received signal prior to the received signal arriving at the feedback loop.

40. The receiver of Claim 37, wherein a receiver is associated with each channel in the multi-channel communication system and each receiver receives an incoming cancellation signal from each of the other receivers.

5           41. A method for noise reduction in a multi-channel communication system having two or more receivers comprising:  
            receiving a signal over a channel;  
            receiving one or more cancellation signals from other receivers in the multi-channel communication system;  
10           processing the received signal and the one or more cancellation signals from the other receivers to generate a feedback signal; and  
            combining the feedback signal with the received signal to cancel coupling in the received signal.

15           42. The method of Claim 41, further comprising generating one or more outgoing cancellation signals and providing the one or more outgoing cancellation signals to other receivers in the multi-channel communication system.

            43. The method of Claim 41, further comprising combining the feedback  
20           signal with the one or more cancellation signals from the other receivers prior to combining the feedback signal with the received signal to reduce noise in the received signal.

            44. The method of Claim 41, wherein processing comprises processing  
25           with a decision feedback equalizer.

            45. The method of Claim 44, wherein processing further comprises quantizing the combination of the received signal and the one or more cancellation signals to one of one or more discrete levels prior to processing.

30

46. A system for canceling one or more FEXT signals that have coupled onto a transmitted signal to create a modified signal in a multi-channel communication device comprising:

means for receiving the modified signal over a channel in the multi-channel  
5 communication system;

means for combining the modified signal with a feedback signal isolate the transmitted signal;

means for generating the feedback signal comprising:

means for filtering the isolated transmitted signal to create a filtered  
10 signal;

means for receiving and combining and the filtered signal and one more cancellation signals from other receivers in the multi-channel communication device;

means for generating one or more cancellation signals to be outputted to one  
15 or more other receivers.

47. The system of Claim 46, wherein means for generating further comprises a decision device.

20 48. The system of Claim 46, wherein the means for generating one or more cancellation signals comprises:

means for combining the transmitted signal and the feedback signal to create a cancellation filter input signal, and

means for processing the cancellation filter input signal to create FEXT  
25 cancellation signals to be provided to other receivers.

**ABSTRACT**

A method and apparatus for noise reduction in a multi-channel communication  
5 system is disclosed. In one embodiment one or more FEXT filters in each receiver of  
each station of a communication system generate one or more cancellation signals.  
Each FEXT filter may have a unique transfer function that is the inverse of the  
ELFEXT coupling of the channel with which the FEXT filter is associated. The one  
or more cancellation signals are routed to other receivers in the station and combined  
10 with each receiver's respective incoming signal to cancel FEXT coupling. In one  
embodiment one or more precode FEXT filters are utilized in each transmitter of a  
station to generate one or more precoder cancellation signals. The precoder  
cancellation signals are routed to other transmitters within the station and combined  
with outgoing signals to cancel the effects of FEXT coupling prior to transmission of  
15 the outgoing signals.

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WEIDE &  
MILLER, Ltd.

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PATENT, TRADEMARK, COPYRIGHT & TRADE SECRET MATTERS

11<sup>th</sup> Floor, Suite 1130, Phoenix Building  
330 South 3<sup>rd</sup> Street  
Las Vegas, NV 89101  
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Facsimile (702)-382-4805

E-mail: [CMiller@WeideMiller.com](mailto:CMiller@WeideMiller.com)  
On the web: [www.WeideMiller.com](http://www.WeideMiller.com)

CHAD W. MILLER  
REGISTERED PATENT ATTORNEY  
LICENSED IN CALIFORNIA & NEVADA

October 7, 2002

VIA PRIORITY MAIL

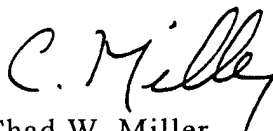
Mr. Ben Charny  
Executive Vice President and CFO  
SolarFlare Communications, Inc.  
9501 Jeronimo Rd., Suite 100  
Irvine, CA 92618

RE: October 2002 Invoice

Dear Ben:

Enclosed is our invoice for October 2002. Please contact me if you have any questions.

Best Regards,



Chad W. Miller

Enclosure

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: October 06, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**  
To: **Subject Matter: General Intellectual Property Representation**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
9/5/02	CWM	Update status report	0.10 220.00/hr	22.00
9/11/02	CWM	Draft e-mail to G. Zimmerman providing updated status report; update status report	0.10 220.00/hr	22.00
9/25/02	CWM	Conference with B. Jones regarding status of patent matters	0.20 220.00/hr	44.00
For professional services rendered			<hr/> 0.40	<hr/> \$88.00
<b>Balance due</b>				<hr/> <b>\$88.00</b> <hr/>

In Reference      **Weide & Miller Ref. No.:** SLRFLR.0002P  
To:                    **Subject Matter:** Patent Prosecution  
                         **Title:** Method and Apparatus for Channel Equalization  
                         **Serial No.:** 10/188,274

	<u><b>Amount</b></u>
Previous balance	<b>\$104.00</b>
10/4/02 Payment - thank you	<u>(\$104.00)</u>
Total payments and adjustments	<b>(\$104.00)</b>
 <b>Balance due</b>	 <u><u><b>\$0.00</b></u></u>

In Reference      **Weide & Miller Ref. No.:** SLRFLR.0003P  
To:                    **Subject Matter:** Patent Prosecution  
                         **Title:** Communication System  
                         **Serial No.:** 10/194,775

	<u>Amount</u>
Previous balance	<b>\$36.00</b>
10/4/02 Payment - thank you	<u>(\$36.00)</u>
Total payments and adjustments	<b>(\$36.00)</b>
<b>Balance due</b>	<u><u><b>\$0.00</b></u></u>



In Reference      **Weide & Miller Ref. No.:** SLRFLR.0004P  
To:                    **Subject Matter:** Patent Prosecution  
                         **Title:** Method and Apparatus for Joint Equalization and Crosstalk Mitigation  
                         **Serial No.:** Not yet assigned

	<u>Amount</u>
Previous balance	<b>\$3,696.00</b>
10/4/02 Payment - thank you	<u>(\$3,696.00)</u>
Total payments and adjustments	<b>(\$3,696.00)</b>
<b>Balance due</b>	<u><u><b>\$0.00</b></u></u>

In Reference      **Weide & Miller Ref. No.:** SLRFLR.0005P  
To:                    **Subject Matter:** Patent Prosecution  
                         **Title:** Method and Apparatus for Constellation Shaping  
                         **Serial No.:** 10/194,741

	<u>Amount</u>
Previous balance	\$104.00
10/4/02 Payment - thank you	<u>(\$104.00)</u>
Total payments and adjustments	<u>(\$104.00)</u>
<b>Balance due</b>	<u><u>\$0.00</u></u>

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Multiple Channel Interference Cancellation**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
9/5/02	CWM	Draft text associated with method of operation figures and update figures	3.30 220.00/hr	726.00
9/6/02	CWM	Draft claims and draft portion of application relation to method of operation	5.70 220.00/hr	1,254.00
9/9/02	CWM	Draft claims and send application to W. Jones via e-mail	4.80 220.00/hr	1,056.00
9/17/02	CWM	Conference with B. Jones regarding patent application	0.70 220.00/hr	154.00
For professional services rendered			14.50	\$3,190.00
Previous balance				\$396.00
10/4/02	Payment - thank you			(\$396.00)
Total payments and adjustments				(\$396.00)
Balance due				\$3,190.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Bandwidth Enhancement of Transformers**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
9/12/02	CWM	Draft specification and modify figures of patent application; draft description of figures	4.60 220.00/hr	1,012.00
9/13/02	CWM	Draft specification of patent application	5.70 220.00/hr	1,254.00
9/15/02	CWM	Draft portion of application concerning Figures 7A and 7B; update Description of Figures	0.90 220.00/hr	198.00
9/16/02	CWM	Draft patent application claims and abstract	5.70 220.00/hr	1,254.00
9/17/02	CWM	Revise portion of patent application; short conference call with inventor to verify terminology	1.30 220.00/hr	286.00
9/25/02	CWM	Conference with inventors regarding status and to discuss one aspect of invention	0.30 220.00/hr	66.00
For professional services rendered			<u>18.50</u>	<u>\$4,070.00</u>
<b>Balance due</b>				<u><u>\$4,070.00</u></u>

In Reference **Weide & Miller Ref. No.: SLRFLR.0008P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Cancellation Using Mixed Signal Processing**  
**Serial No.: Not yet assigned**

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
9/2/02	CWM	Draft patent application and create figures	4.30 220.00/hr	946.00
9/3/02	CWM	Review and revise application; draft figures relating to method of operation	2.80 220.00/hr	616.00
9/4/02	CWM	Continue draft patent application and create figures	3.40 220.00/hr	748.00
9/7/02	CWM	Draft claims and draft portion of application relation to method of operation of mixed signal cancellation	4.30 220.00/hr	946.00
9/9/02	CWM	Revise portion of application dealing with mixed signal cancellation	0.80 220.00/hr	176.00
For professional services rendered			<u>15.60</u>	<u>\$3,432.00</u>
<b>Balance due</b>				<u><u>\$3,432.00</u></u>

In Reference **Weide & Miller Ref. No.: SLRFLR.0010P**  
To: **Subject Matter: Patent Prosecution**  
**Title: PCS for 'Reshape' Communication Device**  
**Serial No.: Not yet assigned**

**Professional Services**

		<u>Hrs/Rate</u>	<u>Amount</u>
9/18/02	Schedule disclosure meeting with B. McClellan; review e-mail with attachments	0.50 220.00/hr	110.00
9/25/02	Conference with B. McClellan to obtain invention disclosure; prepare for same by reviewing disclosure documents and portion of specification	5.30 220.00/hr	1,166.00
	For professional services rendered	<u>5.80</u>	<u>\$1,276.00</u>

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: October 06, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference **Weide & Miller Ref. No.: SLRFLR.0001G**  
To: **Subject Matter: General Intellectual Property Representation**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$88.00	\$0.00	\$88.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0002P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Channel Equalization**  
**Serial No.: 10/188,274**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$0.00	\$0.00	\$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0003P**  
To: **Subject Matter: Patent Prosecution**  
**Title: Communication System**  
**Serial No.: 10/194,775**

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$0.00	\$0.00	\$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0004P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Joint Equalization and Crosstalk Mitigation**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0005P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Constellation Shaping**  
**Serial No.: 10/194,741**

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0006P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Multiple Channel Interference Cancellation**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$3,190.00	\$0.00	\$3,190.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0007P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Bandwidth Enhancement of Transformers**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$4,070.00	\$0.00	\$4,070.00



In Reference **Weide & Miller Ref. No.: SLRFLR.0008P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Cancellation Using Mixed Signal Processing**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$3,432.00	\$0.00	\$3,432.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0009P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: Method and Apparatus for Noise Cancellation Based on Transmitter Processing**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference **Weide & Miller Ref. No.: SLRFLR.0010P**  
 To: **Subject Matter: Patent Prosecution**  
**Title: PCS for 'Reshape' Communication Device**  
**Serial No.: Not yet assigned**

New Fees	New Costs	Total New Charges
\$1,276.00	\$0.00	\$1,276.00

Summary For All Matters:

\$12,056.00	\$0.00	\$12,056.00
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GRAND TOTAL OF ALL AMOUNTS  
 DUE:

\$12,056.00

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WEIDE &  
MILLER, Ltd.

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11<sup>th</sup> Floor, Suite 1130, Phoenix Building  
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Las Vegas, NV 89101  
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E-mail: CMiller@WeideMiller.com  
On the web: www.WeideMiller.com

CHAD W. MILLER  
REGISTERED PATENT ATTORNEY  
LICENSED IN CALIFORNIA & NEVADA

November 5, 2002  
VIA PRIORITY MAIL


Mr. Ben Charny  
Executive Vice President and CFO  
SolarFlare Communications, Inc.  
9501 Jeronimo Rd., Suite 100  
Irvine, CA 92618

RE: November 2002 Invoice

Dear Ben:

Enclosed is our invoice for November 2002. Please contact me if you have any questions.

Best Regards,

  
Chad W. Miller

Enclosure

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: November 05, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0001G  
**Subject Matter:** General Intellectual Property Representation

**Professional Services**

	<u>Hrs/Rate</u>	<u>Amount</u>
10/1/02 CWM Update and send status report	0.10 220.00/hr	22.00
For professional services rendered	0.10	<b>\$22.00</b>

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0002P

**Subject Matter:** Patent Prosecution

**Title:** Method and Apparatus for Channel Equalization

**Serial No.:** 10/188,274

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
10/3/02	CWM	Draft letter enclosing Notice of Recordation of Assignment; review same for accuracy	0.20 220.00/hr	44.00
10/29/02	CWM	Draft letter enclosing Corrected Filing Receipt and review same for accuracy	0.20 220.00/hr	44.00
For professional services rendered			0.40	<b>\$88.00</b>

In Reference To: **Weide & Miller Ref. No.: SLRFLR.0003P**

**Subject Matter:** Patent Prosecution

**Title:** Communication System

**Serial No.:** 10/194,775

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
10/3/02	CWM	Draft letter enclosing Notice of Recordation of Assignment; review same for accuracy	0.20 220.00/hr	44.00
10/25/02	CWM	Prepare Information Disclosure Statement and file same with Patent Office	0.90 220.00/hr	198.00
10/28/02	CWM	Draft and send letter to W. Jones enclosing Information Disclosure Statement that was filed with Patent Office	0.10 220.00/hr	22.00
For professional services rendered			1.20	\$264.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0005P

**Subject Matter:** Patent Prosecution

**Title:** Method and Apparatus for Constellation Shaping

**Serial No.:** 10/194,741

**Professional Services**

			<u><b>Hrs/Rate</b></u>	<u><b>Amount</b></u>
10/3/02	CWM	Draft letter enclosing Notice of Recordation of Assignments; review same for accuracy	0.20 220.00/hr	44.00
		For professional services rendered	<hr/> 0.20	<hr/> \$44.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0007P

**Subject Matter:** Patent Prosecution

**Title:** Method and Apparatus for Bandwidth Enhancement of Transformers

**Serial No.:** Not yet assigned

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
10/2/02	CWM	Review and revise patent application	4.80 220.00/hr	1,056.00
10/13/02	CWM	Review and revise figures; supplement application	3.90 220.00/hr	858.00
10/15/02	CWM	Draft letter sending application to inventors	0.10 220.00/hr	22.00
For professional services rendered			8.80	<b>\$1,936.00</b>

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0010P

**Subject Matter:** Patent Prosecution

**Title:** Transmit Reshaper

**Serial No.:** Not yet assigned

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
10/3/02	CWM	Outline specification and outline figures	4.30 220.00/hr	946.00
10/4/02	CWM	Draft background section and outline figures	1.20 220.00/hr	264.00
10/8/02	CWM	Draft background section; create figures	3.30 220.00/hr	726.00
10/9/02	CWM	Review disclosure notes; create figures; outline application	2.60 220.00/hr	572.00
10/14/02	CWM	Draft figures and patent application; review disclosure tape	3.60 220.00/hr	792.00
10/15/02	CWM	Draft patent application	5.40 220.00/hr	1,188.00
10/18/02	CWM	Draft patent application	2.80 220.00/hr	616.00
10/20/02	CWM	Review e-mail with attachments from B. McCellan; select figure from attachments for use in application; draft application	1.60 220.00/hr	352.00
10/24/02	CWM	Draft portion of patent application dealing with receiver	1.10 220.00/hr	242.00
For professional services rendered			25.90	\$5,698.00



In Reference To: **Weide & Miller Ref. No.: SLRFLR.0011G****Subject Matter:** Patent Prosecution**Title:** Receive Reshaper**Serial No.:** Not yet assigned**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
10/21/02	CWM	Draft patent application	1.80 220.00/hr	396.00
10/28/02	CWM	Draft patent application	0.40 220.00/hr	88.00
10/29/02	CWM	Draft portion of application dealing with receive reshaper	2.30 220.00/hr	506.00
10/30/02	CWM	Create new figures; draft portion of application dealing with new figures and review last part of disclosure tape	2.80 220.00/hr	616.00
10/31/02	CWM	Draft patent application	1.40 220.00/hr	308.00
For professional services rendered			8.70	<b>\$1,914.00</b>

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: November 05, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0001G  
**Subject Matter:** General Intellectual Property Representation

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$22.00	\$0.00	\$22.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0002P  
**Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Channel Equalization  
**Serial No.:** 10/188,274

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$88.00	\$0.00	\$88.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0003P  
**Subject Matter:** Patent Prosecution  
**Title:** Communication System  
**Serial No.:** 10/194,775

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$264.00	\$0.00	\$264.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0005P  
**Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Constellation Shaping  
**Serial No.:** 10/194,741

New Fees	New Costs	Total New Charges
\$44.00	\$0.00	\$44.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0006P  
**Subject Matter:** Patent Prosecution  
**Title:** Multiple Channel Interference Cancellation  
**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0007P  
**Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Bandwidth Enhancement of Transformers  
**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$1,936.00	\$0.00	\$1,936.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0008P  
**Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Cancellation Using Mixed Signal Processing  
**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0010P

**Subject Matter:** Patent Prosecution

**Title:** Transmit Reshaper

**Serial No.:** Not yet assigned

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$5,698.00	\$0.00	\$5,698.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0011G

**Subject Matter:** Patent Prosecution

**Title:** Receive Reshaper

**Serial No.:** Not yet assigned

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$1,914.00	\$0.00	\$1,914.00

Summary For All Matters:

<u>\$9,966.00</u>	<u>\$0.00</u>	<u>\$9,966.00</u>
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GRAND TOTAL OF ALL AMOUNTS  
DUE:

\$9,966.00

## Chad Miller

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**From:** Chad W. Miller [CMiller@WeideMiller.com]  
**Sent:** Monday, September 09, 2002 8:42 AM  
**To:** William Jones Ph. D.; George Zimmerman  
**Subject:** Electronic Copy of SLRFLR.0004P (Equalization and FEXT Mitigation)  
**Attachments:** CWM-W-0066.doc; SLRFLR.0004P.vsd; SLRFLR.0004L.vsd

Attached is an electronic copy of the above-referenced application with Figures.

Please let me know if you have any questions. I look forward to your feedback and any changes you may have.

Best Regards,

Chad W. Miller

**Weide & Miller, Ltd**  
**CMiller@WeideMiller.com**  
**702-382-4804**

This communication is for its intended recipient only, and may contain information that is privileged, confidential and exempt from disclosure under applicable law. If you are not the intended recipient or the employee or agent responsible for delivering this communication to the intended recipient, you are hereby notified that any unauthorized use, dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone (702-382-4804) or e-mail reply, delete it from your system, and destroy any hard copy you may have printed. Thank you.

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WEIDE &  
MILLER, Ltd.

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11<sup>th</sup> Floor, Suite 1130, Phoenix Building  
330 South 3<sup>rd</sup> Street  
Las Vegas, NV 89101  
Telephone (702)-382-4804  
Facsimile (702)-382-4805

E-mail: CMiller@WeideMiller.com  
On the web: www.WeideMiller.com

CHAD W. MILLER  
REGISTERED PATENT ATTORNEY  
LICENSED IN CALIFORNIA & NEVADA

December 4, 2002

VIA PRIORITY MAIL

Mr. Ben Charny  
Executive Vice President and CFO  
SolarFlare Communications, Inc.  
9501 Jeronimo Rd., Suite 100  
Irvine, CA 92618

RE: December 2002 Invoice

Dear Ben:

Enclosed is our invoice for services provided in November. Please contact me if you have any questions.

Best Regards,



Chad W. Miller

Enclosure

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: December 03, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0001G  
**Subject Matter:** General Intellectual Property Representation

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
11/1/02	CWM	Update and send status report	0.10 220.00/hr	22.00
11/4/02	CWM	Draft e-mail to G. Zimmerman and W. Jones regarding foreign rights	0.20 220.00/hr	44.00
	CWM	Draft e-mail to G. Zimmerman and B. Charney providing billing estimate; obtain billing estimate	0.10 220.00/hr	NO CHARGE
11/5/02	CWM	Conference with W. Jones regarding potential disclosure Standards Meeting; receive revised application; receive e-mail authorizing filing of provisional application; research related case and suggest filing of two applications in e-mailed response; initiate filing of provisional	0.70 220.00/hr	154.00
11/27/02	CWM	Conference with W. Jones to schedule meeting	0.10 220.00/hr	22.00
For professional services rendered			1.20	<b>\$242.00</b>

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0004P**Subject Matter:** Patent Prosecution**Title:** Method and Apparatus for Joint Equalization and Crosstalk Mitigation**Serial No.:** Not yet assigned**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
11/7/02	CWM	Revise specification to place application in form for provisional filing; combine both applications to single provisional specification with combined claims and figures; prepare transmittal and file provisional application	2.10 220.00/hr	462.00
11/12/02	CWM	Draft letter enclosing filed provisional patent application	0.10 220.00/hr	22.00
11/20/02	CWM	Draft letter regarding receipt of postcard for provisional patent application filing	0.10 220.00/hr	22.00
11/27/02	CWM	Conference with W. Jones regarding changes to patent application	0.30 220.00/hr	66.00
For professional services rendered			2.60	<b>\$572.00</b>

**Additional Charges :**

11/7/02	Filing Fee (provisional application)	80.00
Total costs		<b>\$80.00</b>
Total amount of this bill		<b>\$652.00</b>



In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0006P  
**Subject Matter:** Patent Prosecution  
**Title:** Multiple Channel Interference Cancellation  
**Serial No.:** Not yet assigned

**Professional Services**

			<u><b>Hrs/Rate</b></u>	<u><b>Amount</b></u>
11/27/02	CWM	Draft e-mail to W. Jones attaching second draft of application	0.10 220.00/hr	22.00
For professional services rendered			<u>0.10</u>	<u><b>\$22.00</b></u>

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0007P

**Subject Matter:** Patent Prosecution

**Title:** Method and Apparatus for Bandwidth Enhancement of Transformers

**Serial No.:** Not yet assigned

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
11/27/02	CWM	Brief conference with inventor regarding status of case	0.10 220.00/hr	22.00
		For professional services rendered	0.10	<b>\$22.00</b>

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0008P

**Subject Matter:** Patent Prosecution

**Title:** Method and Apparatus for Cancellation Using Mixed Signal Processing

**Serial No.:** Not yet assigned

**Professional Services**

			<u><b>Hrs/Rate</b></u>	<u><b>Amount</b></u>
11/20/02	CWM	Revise patent application	0.80 220.00/hr	176.00
11/21/02	CWM	Review and revise patent application	1.20 220.00/hr	264.00
11/22/02	CWM	Revise patent application based on comments inventors	5.20 220.00/hr	1,144.00
For professional services rendered			<hr/> 7.20	<hr/> \$1,584.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0011G

**Subject Matter:** Patent Prosecution

**Title:** Receive Reshaper

**Serial No.:** Not yet assigned

**Professional Services**

			<u>Hrs/Rate</u>	<u>Amount</u>
11/1/02	CWM	Draft portions of patent application dealing with receive reshaper	5.40 220.00/hr	1,188.00
		For professional services rendered	5.40	<b>\$1,188.00</b>

**Weide & Miller, Ltd.**  
330 South 3rd Street  
Suite 1130  
Las Vegas, NV 89101  
Voice: 702-382-4804  
Facsimile: 702-382-4805

Date Generated/Mailed: December 03, 2002

Invoice submitted to: SolarFlare Communications, Inc.  
9501 Jeronimo Road, Suite 100  
Irvine CA 92618

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0001G  
**Subject Matter:** General Intellectual Property Representation

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$242.00	\$0.00	\$242.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0002P  
**Subject Matter:** Patent Prosecution  
**Title:** Method and Apparatus for Channel Equalization  
**Serial No.:** 10/188,274

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0003P  
**Subject Matter:** Patent Prosecution  
**Title:** Communication System  
**Serial No.:** 10/194,775

<u>New Fees</u>	<u>New Costs</u>	<u>Total New Charges</u>
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0004P

**Subject Matter:** Patent Prosecution

**Title:** Method and Apparatus for Joint Equalization and Crosstalk Mitigation

**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$572.00	\$80.00	\$652.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0005P

**Subject Matter:** Patent Prosecution

**Title:** Method and Apparatus for Constellation Shaping

**Serial No.:** 10/194,741

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0006P

**Subject Matter:** Patent Prosecution

**Title:** Multiple Channel Interference Cancellation

**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$22.00	\$0.00	\$22.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0007P

**Subject Matter:** Patent Prosecution

**Title:** Method and Apparatus for Bandwidth Enhancement of Transformers

**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$22.00	\$0.00	\$22.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0008P**Subject Matter:** Patent Prosecution**Title:** Method and Apparatus for Cancellation Using Mixed Signal Processing**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$1,584.00	\$0.00	\$1,584.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0010P**Subject Matter:** Patent Prosecution**Title:** Transmit Reshaper**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$0.00	\$0.00	\$0.00

In Reference To: **Weide & Miller Ref. No.:** SLRFLR.0011G**Subject Matter:** Patent Prosecution**Title:** Receive Reshaper**Serial No.:** Not yet assigned

New Fees	New Costs	Total New Charges
\$1,188.00	\$0.00	\$1,188.00

Summary For All Matters:

\$3,630.00	\$80.00	\$3,710.00
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GRAND TOTAL OF ALL AMOUNTS  
DUE:

\$3,710.00

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Slip Listing

Page 1

Selection Criteria

Slip.Date 9/1/2002 - 10/31/2002  
Slip.Billed Yes  
Slip.Billing Status Billable  
Slip.Classification Open  
Time.Selection Include: Chad W. Miller

Rate Info - identifies rate source and level

Slip ID	Dates and Time	Posting Status	Description	Timekeeper Activity	Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
10871	TIME			Chad W. Miller		3.40	220.00	748.00
	9/4/2002			Draft		0.00	T@1	
	Billed	G:4614	10/6/2002	SLRFLR.0008P		0.00		
			Continue draft patent application and create figures			0.00		
10872	TIME			Chad W. Miller		4.30	220.00	946.00
	9/2/2002			Draft		0.00	T@1	
	Billed	G:4614	10/6/2002	SLRFLR.0008P		0.00		
			Draft patent application and create figures			0.00		
10873	TIME			Chad W. Miller		0.10	220.00	22.00
	9/3/2002			Draft		0.00	T@1	
	Billed	G:4492	10/3/2002	[REDACTED].0001G		0.00		
			Draft billing estimate and provide same to K. DiMino			0.00		
10876	TIME			Chad W. Miller		0.10	220.00	22.00
	9/3/2002			Draft		0.00	T@1	
	Billed	G:4460	9/25/2002	[REDACTED].0001G		0.00		
			Update and send status reports			0.00		
10877	TIME			Chad W. Miller		0.10	220.00	22.00
	9/3/2002			Draft		0.00	T@1	
	Billed	G:4597	10/6/2002	[REDACTED].0001G		0.00		
			Update and send status reports			0.00		
10878	TIME			Chad W. Miller		0.10	220.00	22.00
	9/3/2002			Draft		0.00	T@1	
	Billed	G:5386	12/8/2002	[REDACTED].0001G		0.00		
			Update and send status reports			0.00		
10880	TIME			Chad W. Miller		2.30	220.00	506.00
	9/3/2002			Draft		0.00	T@1	
	Billed	G:6206	3/12/2003	[REDACTED].0014P		0.00		
			Revise application based on comments and draft additional claims; send same to K. Jones			0.00		
10881	TIME			Chad W. Miller		2.80	220.00	616.00
	9/3/2002			Draft		0.00	T@1	
	Billed	G:4614	10/6/2002	SLRFLR.0008P		0.00		
			Review and revise application; draft figures relating to method of operation			0.00		



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Slip Listing

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Slip ID	Dates and Time	Timekeeper	Units	Rate	Slip Value
Posting Status		Activity	DNB Time	Rate Info	
Description		Client	Est. Time	Bill Status	
		Reference	Variance		
10882	TIME	Chad W. Miller	0.50	220.00	110.00
9/6/2002		Conference	0.00	T@1	
Billed	G:4492	10/3/2002 [REDACTED]0001G	0.00		
Conference with D. Nelson regarding status of applications; forward second copies of application in electronic form to inventors; review inventors comments			0.00		
10883	TIME	Chad W. Miller	5.70	220.00	1254.00
9/6/2002		Conference	0.00	T@1	
Billed	G:4612	10/6/2002 SLRFLR.0006P	0.00		
Draft claims and draft portion of application relation to method of operation			0.00		
10884	TIME	Chad W. Miller	4.30	220.00	946.00
9/7/2002		Conference	0.00	T@1	
Billed	G:4614	10/6/2002 SLRFLR.0008P	0.00		
Draft claims and draft portion of application relation to method of operation of mixed signal cancellation			0.00		
10885	TIME	Chad W. Miller	0.10	220.00	22.00
9/5/2002		Draft	0.00	T@1	
Billed	G:4607	10/6/2002 SLRFLR.0001G	0.00		
Update status report			0.00		
10886	TIME	Chad W. Miller	0.40	220.00	88.00
9/5/2002		Conference	0.00	T@1	
Billed	G:4630	10/6/2002 [REDACTED]0001G	0.00		
Prepare for meeting and general IP discussion during conference with T. Dreaper and M. Yin			0.00		
10887	TIME	Chad W. Miller	1.10	220.00	242.00
9/5/2002		Conference	0.00	T@1	
Billed	G:4636	10/6/2002 [REDACTED]0008P	0.00		
Conference with inventors to obtain invention disclosure for BacaJack			0.00		
10889	TIME	Chad W. Miller	0.40	220.00	88.00
9/5/2002		Conference	0.00	T@1	
Billed	G:5198	11/17/2002 [REDACTED]0004P	0.00		
Conference with T. Dreaper regarding prior art issues; conduct research and discuss same with RSW			0.00		
10891	TIME	Chad W. Miller	0.20	220.00	44.00
9/5/2002		Conference	0.00	T@1	
Billed	G:4633	10/6/2002 [REDACTED]0005T	0.00		
Initiate preparation of trademark applications			0.00		
10892	TIME	Chad W. Miller	0.20	220.00	44.00
9/5/2002		Conference	0.00	T@1	
Billed	G:4635	10/6/2002 [REDACTED]0007T	0.00		
Initiate preparation of trademark applications			0.00		

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Weide & Miller, Ltd.  
Slip Listing

Page 3

Slip ID	Dates and Time	Timekeeper	Units	Rate	Slip Value
	Posting Status	Activity	DNB Time	Rate Info	
	Description	Client Reference	Est. Time	Bill Status	
			Variance		
10893	TIME	Chad W. Miller	0.10	220.00	22.00
	9/5/2002	Draft	0.00	T@1	
	Billed	G:4601 10/6/2002 [REDACTED].0001G	0.00		
	Draft letter enclosing maintenance fee transmittal		0.00		
10895	TIME	Chad W. Miller	3.30	220.00	726.00
	9/5/2002	Draft	0.00	T@1	
	Billed	G:4612 10/6/2002 SLRFLR.0006P	0.00		
	Draft text associated with method of operation figures and update figures		0.00		
10930	TIME	Chad W. Miller	5.70	220.00	1254.00
	9/13/2002	Draft	0.00	T@1	
	Billed	G:4613 10/6/2002 SLRFLR.0007P	0.00		
	Draft specification of patent application		0.00		
10933	TIME	Chad W. Miller	0.10	220.00	22.00
	9/13/2002	Review	0.00	T@1	
	Billed	G:4544 10/4/2002 [REDACTED].0016P	0.00		
	Review and propose revisions to Response		0.00		
10934	TIME	Chad W. Miller	4.60	220.00	1012.00
	9/12/2002	Draft	0.00	T@1	
	Billed	G:4613 10/6/2002 SLRFLR.0007P	0.00		
	Draft specification and modify figures of patent application; draft description of figures		0.00		
10937	TIME	Chad W. Miller	0.40	220.00	88.00
	9/11/2002	Draft	0.00	T@1	
	Billed	G:4492 10/3/2002 [REDACTED].0001G	0.00		
	Conference call with K. DiMino; Draft e-mail to K. DiMino regarding request for copy of parent application; declarations and new reference number for case; review follow-up e-mail		0.00		
10938	TIME	Chad W. Miller	0.10	220.00	22.00
	9/11/2002	Draft	0.00	T@1	
	Billed	G:4607 10/6/2002 SLRFLR.0001G	0.00		
	Draft e-mail to G. Zimmerman providing updated status report; update status report		0.00		
10940	TIME	Chad W. Miller	1.80	220.00	396.00
	9/11/2002	Draft	0.00	T@1	
	Billed	G:4631 10/6/2002 [REDACTED].0002P	0.00		
	Review and revise application based on inventors' comments		0.00		
10942	TIME	Chad W. Miller	6.40	220.00	1408.00
	9/10/2002	Draft	0.00	T@1	
	Billed	G:6207 3/12/2003 [REDACTED].0015P	0.00		
	Conference with K. Jones to obtain invention disclosure; begin drafting patent application		0.00		

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Weide & Miller, Ltd.  
Slip Listing

Page 4

Slip ID			Timekeeper	Units	Rate	Slip Value
Dates and Time			Activity	DNB Time	Rate Info	
Posting Status			Client	Est. Time	Bill Status	
Description			Reference	Variance		
10945	TIME		Chad W. Miller	0.20	220.00	44.00
9/10/2002			Draft	0.00	T@1	
Billed	G:4631	10/6/2002	██████████0002P	0.00		
Review changes proposed by inventors and initiate editing of application to achieve certain changes				0.00		
10946	TIME		Chad W. Miller	4.80	220.00	1056.00
9/9/2002			Draft	0.00	T@1	
Billed	G:4612	10/6/2002	SLRFLR.0006P	0.00		
Draft claims and send application to W. Jones via e-mail				0.00		
10947	TIME		Chad W. Miller	0.80	220.00	176.00
9/9/2002			Draft	0.00	T@1	
Billed	G:4614	10/6/2002	SLRFLR.0008P	0.00		
Revise portion of application dealing with mixed signal cancellation				0.00		
10948	TIME		Chad W. Miller	0.20	220.00	44.00
9/9/2002			Phone client	0.00	T@1	
Billed	G:4492	10/3/2002	██████████0001G	0.00		
Provide status of outstanding application to K. DiMino				0.00		
10949	TIME		Chad W. Miller	0.10	220.00	22.00
9/9/2002			Phone client	0.00	T@1	
Billed	G:4630	10/6/2002	██████████0001G	0.00		
Schedule upcoming conference				0.00		
11003	TIME		Chad W. Miller	5.70	220.00	1254.00
9/16/2002			Draft	0.00	T@1	
Billed	G:4613	10/6/2002	SLRFLR.0007P	0.00		
Draft patent application claims and abstract				0.00		
11004	TIME		Chad W. Miller	0.20	220.00	44.00
9/16/2002			Draft	0.00	T@1	
Billed	G:5387	12/8/2002	██████████0002P	0.00		
Draft letter to K. Kind enclosing Filing Receipt; review same for accuracy				0.00		
11006	TIME		Chad W. Miller	1.00	220.00	220.00
9/17/2002			Conference	0.00	T@1	
Billed	G:4630	10/6/2002	██████████0001G	0.00		
Conference with M. Yin and T. Dreaper regarding various patent applications and trademarks; prepare for same				0.00		
11007	TIME		Chad W. Miller	0.70	220.00	154.00
9/17/2002			Conference	0.00	T@1	
Billed	G:4612	10/6/2002	SLRFLR.0006P	0.00		
Conference with B. Jones regarding patent application				0.00		

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Weide & Miller, Ltd.  
Slip Listing

Page 5

Slip ID			Timekeeper	Units	Rate	Slip Value
Dates and Time			Activity	DNB Time	Rate Info	
Posting Status			Client	Est. Time	Bill Status	
Description			Reference	Variance		
11008	TIME		Chad W. Miller	0.70	220.00	154.00
9/17/2002			Prep Pleadings	0.00	T@1	
Billed	G:5396	12/8/2002	[REDACTED].0012P	0.00		
Prepare formal papers; identify unconfirmed information; draft e-mail to R. Winder enclosing same				0.00		
11009	TIME		Chad W. Miller	0.10	220.00	22.00
9/17/2002			Draft	0.00	T@1	
Billed	G:5394	12/8/2002	[REDACTED].0010P	0.00		
Draft letter to K. Kind enclosing published PCT patent application and Notice Informing Applicant of Communication to International Designated Offices				0.00		
11011	TIME		Chad W. Miller	0.40	220.00	88.00
9/17/2002			Preparation	0.00	T@1	
Billed	G:4633	10/6/2002	[REDACTED].0005T	0.00		
Review trademark applications and research description of services				0.00		
11012	TIME		Chad W. Miller	0.40	220.00	88.00
9/17/2002			Preparation	0.00	T@1	
Billed	G:4634	10/6/2002	[REDACTED].0006T	0.00		
Review trademark applications and research description of services				0.00		
11013	TIME		Chad W. Miller	0.40	220.00	88.00
9/17/2002			Preparation	0.00	T@1	
Billed	G:4635	10/6/2002	[REDACTED].0007T	0.00		
Review trademark applications and research description of services				0.00		
11014	TIME		Chad W. Miller	1.30	220.00	286.00
9/17/2002			Draft	0.00	T@1	
Billed	G:4613	10/6/2002	SLRFLR.0007P	0.00		
Revise portion of patent application; short conference call with inventor to verify terminology				0.00		
11015	TIME		Chad W. Miller	0.90	220.00	198.00
9/15/2002			Draft	0.00	T@1	
Billed	G:4613	10/6/2002	SLRFLR.0007P	0.00		
Draft portion of application concerning Figures 7A and 7B; update Description of Figures				0.00		
11017	TIME		Chad W. Miller	6.10	220.00	1342.00
9/17/2002			Draft patent application	0.00	T@1	
Billed	G:4636	10/6/2002	[REDACTED].0008P	0.00		
Continue drafting patent application specification.				0.00		
11018	TIME		Chad W. Miller	4.10	220.00	902.00
9/18/2002			Draft patent application	0.00	T@1	
Billed	G:4636	10/6/2002	[REDACTED].0008P	0.00		
Draft patent application specification.				0.00		

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Slip ID	Dates and Time	Posting Status	Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11024	TIME			Chad W. Miller	4.10	220.00	902.00
	9/19/2002			Draft	0.00	T@1	
	Billed	G:4636	10/6/2002	[REDACTED].0008P	0.00		
			Review and revise patent application		0.00		
11029	TIME			Chad W. Miller	0.50	220.00	110.00
	9/19/2002			Conference	0.00	T@1	
	Billed	G:6208	3/12/2003	[REDACTED].0016P	0.00		
			Conference with client to schedule disclosure meeting		0.00		
11067	TIME			Chad W. Miller	1.30	220.00	286.00
	9/18/2002			Review	0.00	T@1	
	Billed	G:5390	12/8/2002	[REDACTED].0005P	0.00		
			Review message from Examiner regarding restriction requirement; review claims and conduct conference with Examiner regarding election of claims; discuss nomination of invention and inventors for Innovators Award with Examiner		0.00		
11068	TIME			Chad W. Miller	3.60	220.00	792.00
	9/18/2002			Review	0.00	T@1	
	Billed	G:4630	10/6/2002	[REDACTED].0001G	0.00		
			Review statement of goods for trademark applications; perform general trademark searching of BACA family; Perform additional searching after discovery of similar marks; discuss same with T. Dreaper; draft agreement for R. Conti; discuss same with T. Dreaper; discuss agreement with RSW; review Bacalette patent assignment document for requirements as it relates recordation at Patent Office		0.00		
11070	TIME			Chad W. Miller	0.10	220.00	22.00
	9/18/2002			Correspondence	0.00	T@1	
	Billed	G:4600	10/6/2002	[REDACTED].0007P	0.00		
			Draft letter to client enclosing publish PCT application		0.00		
11071	TIME			Chad W. Miller	0.50	220.00	110.00
	9/18/2002			Correspondence	0.00	T@1	
	Billed	G:4616	10/6/2002	SLRFLR.0010P	0.00		
			Schedule disclosure meeting with B. McClellan; review e-mail with attachments		0.00		
11099	TIME			Chad W. Miller	0.20	220.00	44.00
	9/23/2002			Draft	0.00	T@1	
	Billed	G:4461	9/25/2002	[REDACTED].0002P	0.00		
			Draft letter to S. Warhola enclosing issued patent application; initiate proof read of patent		0.00		
11104	TIME			Chad W. Miller	0.10	220.00	22.00
	9/23/2002			Draft	0.00	T@1	
	Billed	G:5386	12/8/2002	[REDACTED].0001G	0.00		
			Update and send WIP report		0.00		

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Slip ID	Dates and Time	Posting Status	Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11107	TIME			Chad W. Miller	0.40	220.00	88.00
	9/23/2002			Conference	0.00	T@1	
	Billed	G:5198	11/17/2002	████████.0004P	0.00		
			Outline figures and application		0.00		
11108	TIME			Chad W. Miller	0.10	220.00	22.00
	9/23/2002			Draft	0.00	T@1	
	Billed	G:6205	3/12/2003	████████.0013P	0.00		
			Draft e-mail regarding filing of Demand		0.00		
11109	TIME			Chad W. Miller	0.10	220.00	22.00
	9/24/2002			Draft	0.00	T@1	
	Billed	G:6205	3/12/2003	████████.0013P	0.00		
			Read e-mail from R. Winder regarding filing of Demand		0.00		
11110	TIME			Chad W. Miller	0.70	220.00	154.00
	9/23/2002			Research	0.00	T@1	
	Billed	G:6208	3/12/2003	████████.0016P	0.00		
			Prepare for meeting by reviewing disclosures and researching subject matter of same		0.00		
11115	TIME			Chad W. Miller	2.40	220.00	528.00
	9/24/2002			Conference	0.00	T@1	
	Billed	G:6208	3/12/2003	████████.0016P	0.00		
			Conference with C. Chang to obtain invention disclosure		0.00		
11116	TIME			Chad W. Miller	5.30	220.00	1166.00
	9/25/2002			Conference	0.00	T@1	
	Billed	G:4616	10/6/2002	SLRFLR.0010P	0.00		
			Conference with B. McClellan to obtain invention disclosure; prepare for same by reviewing disclosure documents and portion of specification		0.00		
11117	TIME			Chad W. Miller	0.20	220.00	44.00
	9/25/2002			Conference	0.00	T@1	
	Billed	G:4607	10/6/2002	SLRFLR.0001G	0.00		
			Conference with B. Jones regarding status of patent matters		0.00		
11118	TIME			Chad W. Miller	0.30	220.00	66.00
	9/25/2002			Conference	0.00	T@1	
	Billed	G:4613	10/6/2002	SLRFLR.0007P	0.00		
			Conference with inventors regarding status and to discuss one aspect of invention		0.00		
11119	TIME			Chad W. Miller	5.20	220.00	1144.00
	9/20/2002			Revise	0.00	T@1	
	Billed	G:4636	10/6/2002	████████.0008P	0.00		
			Revise patent application; revise figures		0.00		

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Slip ID			Timekeeper	Units	Rate	Slip Value
Dates and Time			Activity	DNB Time	Rate Info	
Posting Status			Client	Est. Time	Bill Status	
Description			Reference	Variance		
11151	TIME		Chad W. Miller	1.70	220.00	374.00
9/29/2002			Draft	0.00	T@1	
Billed	G:6207	3/12/2003	██████████.0015P	0.00		
Draft patent application and create figures				0.00		
11152	TIME		Chad W. Miller	0.30	220.00	66.00
9/26/2002			Conference	0.00	T@1	
Billed	G:4630	10/6/2002	██████████.0001G	0.00		
Conference with M. Vince at Gaming Control Board to discuss status of information request; draft letter to M. Vince to enclose reports				0.00		
11153	TIME		Chad W. Miller	0.10	220.00	22.00
9/26/2002			Draft	0.00	T@1	
Billed	G:5394	12/8/2002	██████████.0010P	0.00		
Draft letter to K. Kind enclosing copy of proof of Receipt of Demand				0.00		
11155	TIME		Chad W. Miller	1.80	220.00	396.00
9/26/2002			Draft	0.00	T@1	
Billed	G:6207	3/12/2003	██████████.0015P	0.00		
Draft patent application; review disclosure notes				0.00		
11162	TIME		Chad W. Miller	0.20	220.00	44.00
9/27/2002			Conference	0.00	T@1	
Billed	G:5390	12/8/2002	██████████.0005P	0.00		
Conference with K. Hale regarding restriction requirement and filing of divisional application; review and respond to e-mail from R. Winder				0.00		
11163	TIME		Chad W. Miller	0.20	220.00	44.00
9/27/2002			Draft	0.00	T@1	
Billed	G:4630	10/6/2002	██████████.0001G	0.00		
Draft letter to T. Dreaper enclosing letters to records departments; send letter to M. Vince; schedule meeting to discuss application				0.00		
11167	TIME		Chad W. Miller	5.90	220.00	1298.00
9/27/2002			Draft	0.00	T@1	
Billed	G:6207	3/12/2003	██████████.0015P	0.00		
Draft application; review parent to insure proper incorporation; short conference with K. Jones				0.00		
11168	TIME		Chad W. Miller	1.00	220.00	220.00
9/26/2002			File with USPTO	0.00	T@1	
Billed	G:4631	10/6/2002	██████████.0002P	0.00		
Prepare transmittal and assignment recordation cover sheet; file patent application with USPTO				0.00		
11169	EXP		Chad W. Miller	1	589.00	589.00
9/26/2002			Filing Fee			
Billed	G:4631	10/6/2002	██████████.0002P			
U.S. PTO Filing Fee (small entity)						

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Slip ID	Dates and Time	Posting Status	Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11170	EXP			Chad W. Miller	1	40.00	40.00
	9/26/2002			Filing Fee			
	Billed	G:4631	10/6/2002	██████████.0002P			
			Assignment Recordation Fee				
11187	TIME			Chad W. Miller	1.00	220.00	220.00
	9/17/2002			Meeting	0.00	T@1	
	Billed	G:4492	10/3/2002	██████████.0001G	0.00		
			Meet with various inventors at G2E gaming show and discuss various aspects of new products.		0.00		
11188	TIME			Chad W. Miller	4.80	220.00	1056.00
	10/2/2002			Draft	0.00	T@1	
	Billed	G:5114	11/5/2002	SLRFLR.0007P	0.00		
			Review and revise patent application		0.00		
11189	TIME			Chad W. Miller	0.20	220.00	44.00
	10/2/2002			Draft	0.00	T@1	
	Billed	G:5163	11/10/2002	██████████.0001G	0.00		
			Review and revise status report; draft and send letter enclosing application		0.00		
11190	TIME			Chad W. Miller	0.20	190.00	38.00
	10/2/2002			Conference	0.00	C@1	
	Billed	G:5065	11/1/2002	██████████.0000G	0.00		
			Conference with RSW regarding options to deal with game show and new magazine		0.00		
11191	TIME			Chad W. Miller	1.60	220.00	352.00
	10/2/2002			Draft	0.00	T@1	
	Billed	G:6205	3/12/2003	██████████.0013P	0.00		
			Prepare and file Demand		0.00		
11192	TIME			Chad W. Miller	0.10	220.00	22.00
	10/1/2002			Draft	0.00	T@1	
	Billed	G:5386	12/8/2002	██████████.0001G	0.00		
			Update and send status report		0.00		
11193	TIME			Chad W. Miller	0.10	220.00	22.00
	10/1/2002			Draft	0.00	T@1	
	Billed	G:5109	11/5/2002	SLRFLR.0001G	0.00		
			Update and send status report		0.00		
11194	TIME			Chad W. Miller	0.10	220.00	22.00
	10/1/2002			Draft	0.00	T@1	
	Billed	G:4597	10/6/2002	██████████.0001G	0.00		
			Update and send status report		0.00		
11195	TIME			Chad W. Miller	2.40	220.00	528.00
	10/1/2002			Draft	0.00	T@1	
	Billed	G:6207	3/12/2003	██████████.0015P	0.00		
			Draft claims and review prior art article provided by inventors		0.00		



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Slip ID	Dates and Time	Timekeeper	Units	Rate	Slip Value
Posting Status		Activity	DNB Time	Rate Info	
Description		Client	Est. Time	Bill Status	
		Reference	Variance		
11196	TIME	Chad W. Miller	1.10	220.00	242.00
10/1/2002		Draft	0.00	T@1	
Billed	G:4601	10/6/2002 [REDACTED].0001G	0.00		
Review facsimile from D. Sheffey and create			0.00		
Maintenance Fee Status Report					
11197	TIME	Chad W. Miller	0.90	220.00	198.00
10/1/2002		Conference	0.00	T@1	
Billed	G:5196	11/17/2002 [REDACTED].0001G	0.00		
Conference discussing trademark options, other			0.00		
patents and corporate actions					
11198	TIME	Chad W. Miller	1.60	220.00	352.00
10/1/2002		Conference	0.00	T@1	
Billed	G:5201	11/17/2002 [REDACTED].0008P	0.00		
Conference to discuss changes to patent application			0.00		
11199	TIME	Chad W. Miller	0.40	220.00	88.00
9/30/2002		Conference	0.00	T@1	
Billed	G:11371	7/13/2004 [REDACTED].0001G	0.00		
Conference with D. Brass and A. Vadjinia regarding			0.00		
status of cases					
11200	TIME	Chad W. Miller	0.20	220.00	44.00
10/1/2002		Conference	0.00	T@1	
Billed	G:5343	12/8/2002 [REDACTED].0001P	0.00		
Conference with RSW regarding examiner's rejection;			0.00		
review Office Action and Application					
11201	TIME	Chad W. Miller	0.10	220.00	22.00
9/30/2002		Conference	0.00	T@1	
Billed	G:4601	10/6/2002 [REDACTED].0001G	0.00		
Conference with D. Sheffey to discuss maintenance			0.00		
fee notice					
11202	TIME	Chad W. Miller	0.20	220.00	44.00
9/30/2002		Conference	0.00	T@1	
Billed	G:5390	12/8/2002 [REDACTED].0005P	0.00		
Conference with Examiner regarding modification to			0.00		
restriction requirement					
11203	TIME	Chad W. Miller	4.70	220.00	1034.00
9/30/2002		Draft	0.00	T@1	
Billed	G:6207	3/12/2003 [REDACTED].0015P	0.00		
Draft patent application			0.00		
11254	TIME	Chad W. Miller	0.10	220.00	22.00
10/3/2002		Draft	0.00	T@1	
Billed	G:5163	11/10/2002 [REDACTED].0001G	0.00		
Prepare estimate of Sept. invoice and e-mail same to			0.00		
K. DiMino					

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Slip ID	Dates and Time	Timekeeper	Units	Rate	Slip Value
Posting Status		Activity	DNB Time	Rate Info	
Description		Client Reference	Est. Time Variance	Bill Status	
11255	TIME	Chad W. Miller	0.40	220.00	88.00
10/3/2002		Research	0.00	T@1	
Billed	G:5196	11/17/2002 [REDACTED].0001G	0.00		
Research current rules regarding trademark cancellation proceedings and discuss same with RSW			0.00		
11256	TIME	Chad W. Miller	0.20	220.00	44.00
10/3/2002		Draft	0.00	T@1	
Billed	G:5392	12/8/2002 [REDACTED].0007P	0.00		
Draft letter enclosing Notice of Recordation of Assignments; review same for accuracy			0.00		
11257	TIME	Chad W. Miller	0.20	220.00	44.00
10/3/2002		Draft	0.00	T@1	
Billed	G:5110	11/5/2002 SLRFLR.0002P	0.00		
Draft letter enclosing Notice of Recordation of Assignment; review same for accuracy			0.00		
11258	TIME	Chad W. Miller	0.20	220.00	44.00
10/3/2002		Draft	0.00	T@1	
Billed	G:5111	11/5/2002 SLRFLR.0003P	0.00		
Draft letter enclosing Notice of Recordation of Assignment; review same for accuracy			0.00		
11259	TIME	Chad W. Miller	0.20	220.00	44.00
10/3/2002		Draft	0.00	T@1	
Billed	G:5112	11/5/2002 SLRFLR.0005P	0.00		
Draft letter enclosing Notice of Recordation of Assignments; review same for accuracy			0.00		
11263	TIME	Chad W. Miller	0.10	220.00	22.00
10/3/2002		Draft	0.00	T@1	
Billed	G:6205	3/12/2003 [REDACTED].0013P	0.00		
Draft letter enclosing Demand that was filed with Patent Office			0.00		
11264	TIME	Chad W. Miller	0.10	220.00	22.00
10/3/2002		Draft	0.00	T@1	
Billed	G:5388	12/8/2002 [REDACTED].0003P	0.00		
Draft letter enclosing Notice of Publication of Application and copy of published application			0.00		
11265	TIME	Chad W. Miller	0.10	220.00	22.00
10/3/2002		Draft	0.00	T@1	
Billed	G:5156	11/5/2002 [REDACTED].0002P	0.00		
Draft letter enclosing Notice of Publication of Application			0.00		
11266	TIME	Chad W. Miller	0.30	220.00	66.00
10/3/2002		Draft	0.00	T@1	
Billed	G:5161	11/6/2002 [REDACTED].0005P	0.00		
Revise and re-file with U.S. Patent Office a Request for Change of Address			0.00		

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Slip ID	Dates and Time	Posting Status	Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11267	TIME			Chad W. Miller	4.30	220.00	946.00
	10/3/2002			Draft	0.00	T@1	
	Billed	G:5116	11/5/2002	SLRFLR.0010P	0.00		
			Outline specification and outline figures		0.00		
11268	TIME			Chad W. Miller	1.20	220.00	264.00
	10/4/2002			Draft	0.00	T@1	
	Billed	G:5116	11/5/2002	SLRFLR.0010P	0.00		
			Draft background section and outline figures		0.00		
11269	TIME			Chad W. Miller	0.60	220.00	132.00
	10/3/2002			Draft	0.00	T@1	
	Billed	G:5160	11/6/2002	████████.0001G	0.00		
			Draft separate reminders for upcoming maintenance fees; delegate finalization of same to assistant		0.00		
11270	TIME			Chad W. Miller	2.80	220.00	616.00
	10/7/2002			Review	0.00	T@1	
	Billed	G:5158	11/5/2002	████████.0004P	0.00		
			Review Office Action and prior art; create notes regarding potential arguments in favor of allowability; draft e-mail to and call and leave message with inventor (N. Beamish) to obtain input; call Foreign Associate and leave message		0.00		
11271	TIME			Chad W. Miller	0.30	220.00	66.00
	10/7/2002			Review	0.00	T@1	
	Billed	G:5162	11/6/2002	████████.0011P	0.00		
			Review letter from Foreign Associate (Borden, Ladner, and Gervais) regarding maintenance fee; draft letter to D. Sheffey enclosing copy of same		0.00		
11315	TIME			Chad W. Miller	3.90	220.00	858.00
	10/13/2002			Draft	0.00	T@1	
	Billed	G:5114	11/5/2002	SLRFLR.0007P	0.00		
			Review and revise figures; supplement application		0.00		
11317	TIME			Chad W. Miller	1.10	220.00	242.00
	10/10/2002			Draft	0.00	T@1	
	Billed	G:5201	11/17/2002	████████.0008P	0.00		
			Review and revise application; send same to T. Dreaper		0.00		
11318	TIME			Chad W. Miller	1.10	220.00	242.00
	10/10/2002			Draft	0.00	T@1	
	Billed	G:5384	12/8/2002	████████.0007P	0.00		
			Review and revise application to insure that all changes were made and proper draft being sent; send same to D. Huffaker		0.00		
11320	TIME			Chad W. Miller	0.90	220.00	198.00
	10/9/2002			Review	0.00	T@1	
	Billed	G:5159	11/6/2002	████████.0001G	0.00		
			Review e-mails from T. McEwan and client's prior law firm regarding transfer of files; short conversation with Sue from prior law firm; initiate preparation of		0.00		

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	Posting Status	Activity	DNB Time	Rate Info	
	Description	Client	Est. Time	Bill Status	
		Reference	Variance		
11322	TIME	Chad W. Miller	0.30	220.00	66.00
10/9/2002		Draft	0.00	T@1	
Billed	G:5160	11/6/2002 [REDACTED] 0001G	0.00		
	Draft letter to D. Sheffey regarding prior allegation of infringement		0.00		
11326	TIME	Chad W. Miller	2.60	220.00	572.00
10/9/2002		Review	0.00	T@1	
Billed	G:5116	11/5/2002 SLRFLR.0010P	0.00		
	Review disclosure notes; create figures; outline application		0.00		
11329	TIME	Chad W. Miller	3.30	220.00	726.00
10/8/2002		Review	0.00	T@1	
Billed	G:5116	11/5/2002 SLRFLR.0010P	0.00		
	Draft background section; create figures		0.00		
11330	TIME	Chad W. Miller	0.10	220.00	22.00
10/8/2002		Review	0.00	T@1	
Billed	G:5306	12/5/2002 [REDACTED] 0001P	0.00		
	Discuss search results with RSW		0.00		
11356	TIME	Chad W. Miller	5.40	220.00	1188.00
10/15/2002		Draft	0.00	T@1	
Billed	G:5116	11/5/2002 SLRFLR.0010P	0.00		
	Draft patent application		0.00		
11357	TIME	Chad W. Miller	1.80	220.00	396.00
10/15/2002		Draft	0.00	T@1	
Billed	G:5163	11/10/2002 [REDACTED] 0001G	0.00		
	Oversee review of files to ascertain which cases were assigned to International Game Technology; initiate preparation of assignments		0.00		
11358	TIME	Chad W. Miller	0.10	220.00	22.00
10/15/2002		Conference	0.00	T@1	
Billed	G:5160	11/6/2002 [REDACTED] 0001G	0.00		
	Conference call with D. Sheffey to discuss potential infringement matter		0.00		
11360	TIME	Chad W. Miller	0.10	220.00	22.00
10/14/2002		Conference	0.00	T@1	
Billed	G:5197	11/17/2002 [REDACTED] 0002P	0.00		
	Draft letter enclosing post card evidencing filing date and serial number of application		0.00		
11361	TIME	Chad W. Miller	0.30	220.00	66.00
10/14/2002		Draft	0.00	T@1	
Billed	G:5156	11/5/2002 [REDACTED] 0002P	0.00		
	Draft letter enclosing issued patent; initiate proofreading of claims		0.00		

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Posting Status		Activity	DNB Time	Rate Info	
Description		Client	Est. Time	Bill Status	
		Reference	Variance		
11362	TIME	Chad W. Miller	0.20	220.00	44.00
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Billed	G:5161	11/6/2002 [REDACTED] 0005P	0.00		
Draft letter enclosing Request for Change of Address			0.00		
11363	TIME	Chad W. Miller	1.40	220.00	308.00
10/14/2002		Draft	0.00	T@1	
Billed	G:5159	11/6/2002 [REDACTED] 0001G	0.00		
Review facsimile from Nick M.; review and revise assignment documents and Schedule A			0.00		
11364	TIME	Chad W. Miller	3.60	220.00	792.00
10/14/2002		Draft	0.00	T@1	
Billed	G:5116	11/5/2002 SLRFLR.0010P	0.00		
Draft figures and patent application; review disclosure tape			0.00		
11379	TIME	Chad W. Miller	0.80	220.00	176.00
10/18/2002		Conference	0.00	T@1	
Billed	G:5196	11/17/2002 [REDACTED] 0001G	0.00		
Conference with client regarding trademark matters, outstanding patent matters and other intellectual property issues, including trademark cancellation proceedings			0.00		
11380	TIME	Chad W. Miller	1.10	220.00	242.00
10/18/2002		Conference	0.00	T@1	
Billed	G:5201	11/17/2002 [REDACTED] 0008P	0.00		
Conference with client regarding changes to patent application			0.00		
11382	TIME	Chad W. Miller	2.80	220.00	616.00
10/18/2002		Draft	0.00	T@1	
Billed	G:5116	11/5/2002 SLRFLR.0010P	0.00		
Draft patent application			0.00		
11383	TIME	Chad W. Miller	0.70	220.00	154.00
10/18/2002		Draft	0.00	T@1	
Billed	G:5198	11/17/2002 [REDACTED] 0004P	0.00		
Revise first draft of patent application			0.00		
11384	TIME	Chad W. Miller	5.80	220.00	1276.00
10/17/2002		Draft	0.00	T@1	
Billed	G:5198	11/17/2002 [REDACTED] 0004P	0.00		
Continue drafting patent application			0.00		
11386	TIME	Chad W. Miller	0.40	220.00	88.00
10/17/2002		Draft	0.00	T@1	
Billed	G:5159	11/6/2002 [REDACTED] 0001G	0.00		
Short conference with T. McEwan; review and revise assignment documents and add foreign cases to Schedule A			0.00		

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11388	TIME			Chad W. Miller	5.40	220.00	1188.00
	10/16/2002			Draft	0.00	T@1	
	Billed	G:5198	11/17/2002	██████████.0004P	0.00		
			Draft patent application		0.00		
11389	TIME			Chad W. Miller	0.20	220.00	44.00
	10/16/2002			Draft	0.00	T@1	
	Billed	G:5386	12/8/2002	██████████.0001G	0.00		
			Review e-mail from R. Winder and respond to same; obtain requested documents		0.00		
11390	TIME			Chad W. Miller	1.20	220.00	264.00
	10/16/2002			Draft	0.00	T@1	
	Billed	G:5163	11/10/2002	██████████.0001G	0.00		
			Review Schedule A, assignments and propose revisions; draft letter to L. Van Asdale enclosing same		0.00		
11392	TIME			Chad W. Miller	0.60	220.00	132.00
	10/16/2002			Research	0.00	T@1	
	Billed	G:5159	11/6/2002	██████████.0001G	0.00		
			Review and revise Schedule A and Assignment		0.00		
11413	TIME			Chad W. Miller	1.60	220.00	352.00
	10/20/2002			Draft	0.00	T@1	
	Billed	G:5116	11/5/2002	SLRFLR.0010P	0.00		
			Review e-mail with attachments from B. McCellan; select figure from attachments for use in application; draft application		0.00		
11414	EXP			Chad W. Miller	1	636.00	636.00
	10/2/2002			Filing Fee			
	Billed	G:6205	3/12/2003	██████████.0013P			
			Demand Fee				
11456	TIME			Chad W. Miller	1.80	220.00	396.00
	10/21/2002			Draft	0.00	T@1	
	Billed	G:5117	11/5/2002	SLRFLR.0011P	0.00		
			Draft patent application		0.00		
11457	TIME			Chad W. Miller	1.70	220.00	374.00
	10/24/2002			Draft	0.00	T@1	
	Billed	G:5201	11/17/2002	██████████.0008P	0.00		
			Revise patent application based on inventor's comments; create new figure 1B		0.00		
11458	TIME			Chad W. Miller	1.10	220.00	242.00
	10/24/2002			Draft	0.00	T@1	
	Billed	G:5116	11/5/2002	SLRFLR.0010P	0.00		
			Draft portion of patent application dealing with receiver		0.00		
11461	TIME			Chad W. Miller	0.10	220.00	22.00
	10/25/2002			Draft	0.00	T@1	
	Billed	G:5201	11/17/2002	██████████.0008P	0.00		
			Revise Figure 1B		0.00		

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	Posting Status	Activity	DNB Time	Rate Info	
	Description	Client	Est. Time	Bill Status	
		Reference	Variance		
11463	TIME	Chad W. Miller	0.30	220.00	66.00
	10/25/2002	Draft	0.00	T@1	
	Billed	G:5158 11/5/2002 [REDACTED].0004P	0.00		
	Conference call with Foreign Associate regarding upcoming response due date; discuss Examiner's Office Action		0.00		
11465	TIME	Chad W. Miller	0.50	220.00	110.00
	10/25/2002	Conference	0.00	T@1	
	Billed	G:5196 11/17/2002 [REDACTED].0001G	0.00		
	Investigate status of Bacalette trademark application; discuss same with T. Dreaper		0.00		
11466	TIME	Chad W. Miller	0.50	220.00	110.00
	10/25/2002	Conference	0.00	T@1	
	Billed	G:5159 11/6/2002 [REDACTED].0001G	0.00		
	Review assignment recordation documents; review assignment; conference with T. McEwan regarding incorrect date; prepare Fed. Ex. to client returning assignment and providing new assignment		0.00		
11467	TIME	Chad W. Miller	0.20	220.00	44.00
	10/25/2002	Draft	0.00	T@1	
	Billed	G:5157 11/5/2002 [REDACTED].0003P	0.00		
	Prepare and file Request for Status		0.00		
11468	TIME	Chad W. Miller	0.90	220.00	198.00
	10/25/2002	Draft	0.00	T@1	
	Billed	G:5111 11/5/2002 SLRFLR.0003P	0.00		
	Prepare Information Disclosure Statement and file same with Patent Office		0.00		
11469	TIME	Chad W. Miller	1.20	220.00	264.00
	10/28/2002	Draft	0.00	T@1	
	Billed	G:5158 11/5/2002 [REDACTED].0004P	0.00		
	Call S. Torri to obtain inventor contact information; conference call with inventor N. Beamish regarding examination; draft letter with enclosures to inventor; review prior art and application to distinguish prior art; draft letter to Foreign Associate regarding inventor comments		0.00		
11474	TIME	Chad W. Miller	0.50	220.00	110.00
	10/28/2002	Draft	0.00	T@1	
	Billed	G:5392 12/8/2002 [REDACTED].0007P	0.00		
	Prepare Information Disclosure Statement		0.00		
11475	TIME	Chad W. Miller	0.10	220.00	22.00
	10/28/2002	Draft	0.00	T@1	
	Billed	G:5157 11/5/2002 [REDACTED].0003P	0.00		
	Draft and send letter to S. Warhola enclosing Request for Status		0.00		
11476	TIME	Chad W. Miller	0.10	220.00	22.00
	10/28/2002	Draft	0.00	T@1	
	Billed	G:5111 11/5/2002 SLRFLR.0003P	0.00		

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Slip ID	Dates and Time	Timekeeper	Units	Rate	Slip Value
Posting Status		Activity	DNB Time	Rate Info	
Description		Client	Est. Time	Bill Status	
		Reference	Variance		
		Draft and send letter to W. Jones enclosing Information Disclosure Statement that was filed with Patent Office	0.00		
11478	TIME	Chad W. Miller	1.10	220.00	242.00
10/28/2002		File with USPTO	0.00	T@1	
Billed	G:5395	12/8/2002 [REDACTED].0011P	0.00		
Prepare transmittal and file application with Patent Office			0.00		
11479	TIME	Chad W. Miller	0.90	220.00	198.00
10/28/2002		File with USPTO	0.00	T@1	
Billed	G:5396	12/8/2002 [REDACTED].0012P	0.00		
Prepare transmittal and file application with Patent Office			0.00		
11480	TIME	Chad W. Miller	0.40	220.00	88.00
10/28/2002		Draft	0.00	T@1	
Billed	G:5117	11/5/2002 SLRFLR.0011P	0.00		
Draft patent application			0.00		
11481	TIME	Chad W. Miller	0.30	220.00	66.00
10/25/2002		Draft	0.00	T@1	
Billed	G:5395	12/8/2002 [REDACTED].0011P	0.00		
Revise application based on comments from K. Kind; review facsimile and e-mail regarding same			0.00		
11484	EXP	Chad W. Miller	1	1226.00	1226.00
10/28/2002		Filing Fee			
Billed	G:5395	12/8/2002 [REDACTED].0011P			
U.S. Patent and Trademark Office Filing Fee					
11485	EXP	Chad W. Miller	1	40.00	40.00
10/28/2002		Filing Fee			
Billed	G:5395	12/8/2002 [REDACTED].0011P			
U.S. Patent and Trademark Office Assignment Recordation Fee					
11502	TIME	Chad W. Miller	0.30	220.00	66.00
10/29/2002		File Review	0.00	T@1	
Billed	G:5160	11/6/2002 [REDACTED].0001G	0.00		
Review bill from Foreign Associate; initiate investigation of same; draft letter to D. Sheffey enclosing same and await results of investigation			0.00		
11504	TIME	Chad W. Miller	0.10	220.00	22.00
10/29/2002		File Review	0.00	T@1	
Billed	G:6470	4/6/2003 [REDACTED].0005P	0.00		
Review Response to Status Inquiry			0.00		
11505	TIME	Chad W. Miller	0.10	220.00	22.00
10/30/2002		File Review	0.00	T@1	
Billed	G:6470	4/6/2003 [REDACTED].0005P	0.00		
Draft letter to client enclosing Response to Status Inquiry			0.00		



Slip ID	Timekeeper	Units	Rate	Slip Value
Dates and Time	Activity	DNB Time	Rate Info	
Posting Status	Client	Est. Time	Bill Status	
Description	Reference	Variance		
11508	TIME	0.10	220.00	22.00
10/29/2002	Chad W. Miller	0.00	T@1	
Billed	Review	0.00		
G:6205	3/12/2003	0.00		
Review Notice Regarding Communication of		0.00		
International Application to Designated Offices				
11509	TIME	0.40	220.00	88.00
10/29/2002	Chad W. Miller	0.00	T@1	
Billed	Review	0.00		
G:5390	12/8/2002	0.00		
Review Office Action and draft letter to K. Kind		0.00		
enclosing same				
11510	TIME	0.30	220.00	66.00
10/29/2002	Chad W. Miller	0.00	T@1	
Billed	Review	0.00		
G:5386	12/8/2002	0.00		
Update Mindspeed Status Report provided by R.		0.00		
Winder; e-mail same to R. Winder				
11511	TIME	0.30	220.00	66.00
10/29/2002	Chad W. Miller	0.00	T@1	
Billed	Conference	0.00		
G:5158	11/5/2002	0.00		
Conference with N. Beamish regarding his review of		0.00		
prior art and Examiner's statements				
11512	TIME	2.30	220.00	506.00
10/29/2002	Chad W. Miller	0.00	T@1	
Billed	Draft	0.00		
G:5117	11/5/2002	0.00		
Draft portion of application dealing with receive		0.00		
reshaper				
11518	TIME	0.20	220.00	44.00
10/29/2002	Chad W. Miller	0.00	T@1	
Billed	Draft	0.00		
G:5110	11/5/2002	0.00		
Draft letter enclosing Corrected Filing Receipt and		0.00		
review same for accuracy				
11531	TIME	2.40	220.00	528.00
10/30/2002	Chad W. Miller	0.00	T@1	
Billed	File with USPTO	0.00		
G:5159	11/6/2002	0.00		
Review, revise and file eleven assignments and		0.00		
requests for recordation with USPTO; prepare				
transmittal for eleven recordations; discuss same with				
P. Nelson				
11532	TIME	0.60	220.00	132.00
10/30/2002	Chad W. Miller	0.00	T@1	
Billed	Draft	0.00		
G:5159	11/6/2002	0.00		
Draft letter to M. Haynes regarding receipt of files;		0.00		
initiate verification that all files listed on status report				
were received; review status reports to determine				
which files were transferred to Weide & Miller and				
which were sent to T. McEwan; designate client code				
assignment plan				

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Slip ID	Dates and Time	Posting Status	Description	Timekeeper Activity Client Reference	Units DNB Time Est. Time Variance	Rate Rate Info Bill Status	Slip Value
11533	TIME			Chad W. Miller	0.10	220.00	22.00
	10/30/2002			Draft	0.00	T@1	
	Billed	G:5395	12/8/2002	██████████.0011P	0.00		
			Draft letter to K. Kind enclosing filed patent application		0.00		
11534	TIME			Chad W. Miller	0.10	220.00	22.00
	10/30/2002			Draft	0.00	T@1	
	Billed	G:5396	12/8/2002	██████████.0012P	0.00		
			Draft letter to K. Kind enclosing filed patent application		0.00		
11535	TIME			Chad W. Miller	2.80	220.00	616.00
	10/30/2002			Draft	0.00	T@1	
	Billed	G:5117	11/5/2002	SLRFLR.0011P	0.00		
			Create new figures; draft portion of application dealing with new figures and review last part of disclosure tape		0.00		
11536	EXP			Chad W. Miller	1	440.00	440.00
	10/30/2002			Recording Fee			
	Billed	G:5159	11/6/2002	██████████.0001G			
			Recording Fee paid to U.S. Patent and Trademark Office for eleven assignments (paid via deposit account)				
11537	EXP			Chad W. Miller	1	440.00	440.00
	10/31/2002			Recording Fee			
	Billed	G:5159	11/6/2002	██████████.0001G			
			Recording Fee paid to U.S. Patent and Trademark Office for eleven assignments (paid via deposit account)				
11538	TIME			Chad W. Miller	2.20	220.00	484.00
	10/31/2002			File with USPTO	0.00	T@1	
	Billed	G:5159	11/6/2002	██████████.0001G	0.00		
			Review, revise and file eleven assignments and requests for recordation with USPTO; prepare transmittal for eleven recordations; discuss same with P. Nelson		0.00		
11539	TIME			Chad W. Miller	0.60	220.00	132.00
	10/31/2002			Conference	0.00	T@1	
	Billed	G:5159	11/6/2002	██████████.0001G	0.00		
			Conference with T. McEwan regarding filed assignment documents; power of attorney documents; and license and litigation status; delegate P. Nelson to investigate all foreign cases for future assignments; initiate preparation of power of attorney documents		0.00		
11540	TIME			Chad W. Miller	1.40	220.00	308.00
	10/31/2002			Draft	0.00	T@1	
	Billed	G:5117	11/5/2002	SLRFLR.0011P	0.00		
			Draft patent application		0.00		

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Slip ID	Dates and Time	Timekeeper	Units	Rate	Slip Value
Posting Status		Activity	DNB Time	Rate Info	
Description		Client	Est. Time	Bill Status	
		Reference	Variance		
11541	TIME	Chad W. Miller	0.80	220.00	176.00
10/31/2002		Conference	0.00	T@1	
Billed	G:5196	11/17/2002 [REDACTED] 0001G	0.00		
Discuss general IP matters including trademark status, other trademark users, including Mr. Silva, and use of patent pending designation on promotional material			0.00		
11543	TIME	Chad W. Miller	1.40	220.00	308.00
10/31/2002		Conference	0.00	T@1	
Billed	G:5198	11/17/2002 [REDACTED] 0004P	0.00		
Discuss changes to patent application during conference with T. Dreaper and M. Yin			0.00		
11544	TIME	Chad W. Miller	0.20	220.00	44.00
10/31/2002		Draft	0.00	T@1	
Billed	G:5199	11/17/2002 [REDACTED] 0005T	0.00		
Draft letter to T. Dreaper enclosing trademark application; review trademark application for accuracy prior to sending to client			0.00		
11545	TIME	Chad W. Miller	0.20	220.00	44.00
10/31/2002		Draft	0.00	T@1	
Billed	G:5200	11/17/2002 [REDACTED] 0006T	0.00		
Draft letter to T. Dreaper enclosing trademark application; review trademark application for accuracy prior to sending to client			0.00		
11564	TIME	Chad W. Miller	0.10	220.00	22.00
10/15/2002		Draft	0.00	T@1	
Billed	G:5114	11/5/2002 SLRFLR.0007P	0.00		
Draft letter sending application to inventors			0.00		
11578	TIME	Chad W. Miller	0.10	220.00	22.00
10/1/2002		Draft	0.00	T@1	
Billed	G:5155	11/5/2002 [REDACTED] 0001G	0.00		
Update and send status report			0.00		
Grand Total					
			Billable	219.40	51673.00
			Unbillable	0.00	0.00
			Total	219.40	51673.00

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